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RAINFALL AND CROPPING PATTERNS



GOVERNMENT OF INDIA
MINISTRY OF AGRICULTURE AND IRRIGATION
NEW DELHI

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RAINFALL AND CROPPING PATTERNS--STATE SERIES

<i>VOLUME NO.</i>	<i>STATE</i>
I	ANDHRA PRADESH
II	ASSAM
III	BIHAR
IV	GUJARAT
V	HARYANA
VI	HIMACHAL PRADESH
VII	JAMMU & KASHMIR
VIII	KERALA
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RAINFALL AND CROPPING PATTERNS

HIMACHAL PRADESH

INTRODUCTION

1.1 The human population of the country is estimated to rise from the 1971 Census figure of 548 million to 935 million in 2000 AD. This rise calls for increased production. Land resources being limited emphasis has to be placed on increasing productivity per unit area. Temperature and other climatic conditions being favourable for crop production throughout the year over most parts of the country, it is possible to grow more than one crop in a year provided water, the most important input, is available. In some parts of the country, the rainy season is long enough to provide scope for double cropping. This potential is yet to be fully exploited. There is scope for increasing irrigation resources in the country, but our estimates show that the area under irrigation is not expected to be more than 42 per cent of the total cropped area even in 2000 AD as against 22 per cent in 1970-71. Therefore, judicious utilisation of direct rainfall and irrigation water, singly and in combination, will have to be thought of for increasing production.

1.2 Farming technology has so advanced that it is possible to increase crop yields even under rainfed conditions, but the choice of crops would have to depend upon the amount and distribution of the prevailing rainfall. Additionally, it will be necessary that the maximum possible quantity of rain water is conserved in ponds and pools situated either within the farm area or elsewhere, in soil profiles and underground storages so that the same could be readily used to save crops in times of water stress. Not only in rainfed farming but even under irrigated conditions, one will have to plan for the most economic and efficient use of water so as to derive maximum possible benefit from rainfall and reduce dependence on irrigation. This necessitates a close

study of the existing cropping patterns vis-a-vis rainfall patterns aimed at determining the nature of changes needed in the former. The cropping patterns depend primarily on the soil and climatic factors but the evolution of a cropping pattern in course of time is the combined effect of soil, climate, food habits and requirements and economic factors. In the context of increasing production, it is necessary to examine the cropping patterns from a scientific angle and find out possible alternative patterns having higher potential. Accordingly, the Commission undertook a comprehensive study of the rainfall and cropping patterns of the country using taluk or tehsil as unit of area. It covered several other relevant factors such as orography, land use data, human and livestock populations, soil and climate, the object being to make, as far as possible, an integrated assessment.

1.3 Chapter 14 on Rainfall and Cropping Patterns of the Commission's Report presents a consolidated account of the data collected together with analysis of their inter-relationships on all-India basis. In this analysis the Commission has been greatly benefited by the discussions with the concerned officers of State Governments. It was realised that by condensing the vast amount of information collected from each State into the small space of a chapter, many important and peculiar features of individual States were likely to be missed and hence the data and analysis of each State have been presented in separate volumes. The manner of presentation is similar to Chapter 14. It has also been considered desirable to include in each State volume the methodology and suggestions for future cropping patterns, which are practically the same as given in Chapter 14.

2 METHODOLOGY

2.1 The chief features of the study are (a) use of taluk or tehsil as unit of area for all basic data and analysis; (b) introduction of coded numerical forms to express patterns of distribution of monthly rainfall throughout the year, crops and livestock; (c) inclusion of information on orography, temperature, evapotranspiration, rainfall, soil, irrigation, land use, human and livestock populations and yield performance of crops, all of which influence in different ways and degrees the cropping patterns of a place and (d) presentation of coded information on rainfall, crops and livestock on 1:1 million scale maps.

Rainfall Patterns

2.2 A major feature of Indian rainfall is that the southwest monsoon season (June to September) accounts for 70 to 95 per cent of the annual rainfall throughout the country except in the south east peninsula and Kashmir and adjoining hill areas. The monsoon as well as the annual rainfall show large fluctuations from year to year but, as stated in Chapter 13 on Climate and Agriculture, there is no significant evidence of any trend or periodicity

in either of them. Considered in relation to crop production, the total annual or seasonal rainfall does not have much significance and what is its important is distribution during the period of growth of different crops. A relevant question, therefore, is whether rainfall should be examined on a weekly, fortnightly or monthly basis. The coefficient of variation (CV) of monthly rainfall is as high as 40-50 per cent even in the雨iest month of July over most of the central, northern and eastern India. In the south, excluding the west coast, CV is higher and varies from 60 to 100 per cent. The variability of weekly or fortnightly rainfall being still greater, makes the use of either of them undependable as indicators of rainfall distribution. For a macro-study like the present, monthly rainfall data which are more dependable and also the most convenient to handle have been used.

2.3 In order to relate crop production with rainfall, certain norms have to be assumed depending on the duration of the crops and their water requirements. On the basis of available information and the fact that most crops mature in about 90 days, the following broad norms have been drawn up :

- (i) Rainfall greater than 30 cm per month (cm pm) for at least three consecutive months would be suitable for a crop like paddy whose water need is very high.
- (ii) 20-30 cm pm for not less than three consecutive months would be suitable for crops whose water need is high but less than that of paddy, for example, maize and black gram.
- (iii) 10-20 cm pm for at least three consecutive months would be suitable for crops requiring much less water, e.g., bajra and small millets.
- (iv) 5-10 cm pm for three consecutive months would be just sufficient for crops which have low water requirements, e.g., moth (*P. aconitifolius*) and ephemeral grasses.
- (v) Rainfall less than 5 cm pm for three consecutive months is not of much significance for crop production.

2.4 For denoting the year's rainfall distribution using monthly totals, a convenient code in letter symbols with numerical subscripts explained below, has been evolved. The letters A to E in Table 1 indicate the ranges of monthly rainfall and the subscripts to these refer to the number of months having these ranges of rainfall e.g. A₂ indicates two months with rainfall greater than 30 cm pm. The ranges correspond to those stated in the preceding paragraph.

TABLE 1
Code for Rainfall Data

Symbol	Monthly rainfall cm pm
A+	Greater than 30
B	20-30
C	10-20
D*	5-10
E*	Less than 5

+ An examination of monthly rainfall in the country shows that except for areas in the west coast and some hill stations in extreme north-east, normal monthly rainfall seldom exceeds 40 cm.

* In distributions containing ranges of rainfall covered by A or B termed briefly as A&B types amounts less than 10 cm are not so significant and their frequency is generally small. To reduce the number of combinations, D is omitted in A or B type distributions; instead E is used to denote less than 10 cm pm. Thus B₂E₂ would denote two months of 20-30 cm pm and two months less than 10 cm pm rainfall.

The southwest monsoon months of June to September being the principal rainy season dominate the rainfall distributions of the country. To indicate the season's importance, monthly rainfall distribution during June to September is shown in brackets in the annual pattern. To the right of the bracket is the distribution for the post-monsoon months, namely, October to January and to the left that for the pre-monsoon months namely, February to May. In order to explain how such a coded rainfall distribution written in symbols with numerical subscripts has to be interpreted, a hypothetical example may be considered. D₁ E₃ (A₂ B₁ C₁) C₁ D₃, in which for each of the three periods, the symbols are in order of decreasing rainfall which is not necessarily the calendar sequence, can be explained as under :—

- (i) D₁ E₃ represents the period February to May in which one month's rainfall (usually May) is in the range of 5-10 cm and the remaining three months get less than 5 cm pm.
- (ii) A₂ B₁ C₁ represents the period June to September, in which two months (usually July and August) get more than 30 cm pm rainfall, one month (September) gets 20-30 cm and the remaining month, i.e. June gets 10-20 cm.
- (iii) C₁ D₃ represents the period October to January in which October gets 10-20 cm rainfall and the rest 5-10 cm pm.

Boundaries of Rainfall Zones

2.5 Since differences in monthly, seasonal and annual rainfall are not large within short distances, linear interpolation of rainfall data is permissible. Rainfall data being point measurements, isolines for the same or nearly the same type of distribution of monthly rainfall can, therefore, be drawn. These isolines may not necessarily follow the boundaries of taluks which are taken to be unit of area in this study and

hence for delineation of boundaries the following procedure has been adopted :

- (i) Where variations are small, isolines follow the taluk boundaries;
- (ii) where variations are large, isolines delineate the zone boundaries; and
- (iii) any taluk, more than three quarters of which lies outside of a zone is not considered a part of that zone.

2.6 If an identical distribution is observed over two or more adjacent taluks a pattern is said to have evolved and the area covered by it is distinguished as a zone and indicated suitably by a Roman numeral. Rainfall patterns have been identified for the whole country using the methodology described above. The data used for the analysis are the monthly normals of rainfall (1901 to 1950)¹ and the patterns and zones are depicted on all-India map which forms part of Chapter 14 on Rainfall and Cropping Patterns of the Commission's Report.

Cropping Patterns

2.7 The basic data for the study of cropping patterns of the country are the areas under different crops in each of the taluks. A large number of crops are grown in a taluk but most of them occupy small areas, often less than one per cent of the total cropped areas of the taluk. With a view to limiting the number of crops constituting a pattern only those crops are considered which individually occupy 10 per cent or more of the gross cropped area of the taluk. In this process, several crops have to be excluded, even though they may be otherwise important. The minimum limit has been fixed at 70 per cent, so that the number of crops, which together cover at least 70 per cent of the gross cropped area, and in which none occupies less than 10 per cent, is not large. Trial computations have shown that in such distributions any crop occupying more than 10 per cent area is rarely omitted and the number of crops hardly exceeds five. When the same distribution holds good for two or more adjacent taluks, a pattern is obtained.

2.8 As in the case of rainfall, percentage area coverage by crops is expressed by means of numerical subscripts affixed to crop symbols shown in Table 2. The list of crops given below is comprehensive and will hold good for all the States.

TABLE 2
Crop Symbols and Area Intervals

Crop	Symbol
1 rice	Pd
2 wheat	W
3 jowar (kharif)	Jk
4 jowar (rabi)	Jr
5 bajra	B
6 maize	M
7 ragi	R
8 small millets	Mt
9 barley	Ba

Crop	Symbol
10 oats	Oa
11 gram	G
12 pigeonpea (tur)	T
13 pulses other than pigeonpea and gram	Pu
14 groundnut	Gn
15 oilseeds other than groundnut	O
16 cotton	C
17 jute	Ju
18 other fibres	Fb
19 sugarcane	S
20 potato	Pt
21 vegetables	V
22 fruits	Fr
23 tapioca	Ta
24 plantations	L
25 fodder	F
26 chillies	Ch
27 tobacco	To

Area (interval (per cent)	Subscript
70 or more	1
50-70	2
30-50	3
10-30	4
less than 10	5

The crop code contains the crop symbol and the appropriate subscript. In writing crop distribution, the first crop has always the highest area but the rest may not necessarily follow the order of decreasing areas. For example, crop distribution, C₃ Jr₄ Mt₄, means that cotton area is 30-50 per cent, and jowar rabi and millets each occupies 10-30 per cent of the gross cropped area, the total being 70 per cent or more. Two or more taluks having the same distribution of crops constitute a pattern. Cropping patterns so derived have been indicated on maps of 1:1 million size.

Relative Yield Index of Crops

2.9 Besides the absolute figures the yield of a crop has also been expressed as per cent of all-India average which is called Relative Yield Index (RYI). Relative Yield Index values have been computed for the principal crops on the basis of (1968-69 to 1970-71) data available in the records of the Directorate of Economics and Statistics, Ministry of Agriculture and Irrigation.

Livestock Patterns

2.10 The livestock patterns are relevant only insofar as these are related to production of fodder and feeds. As talukwise data were not available for the livestock Census, 1972, those of 1966 Census as published by the States have been used. The animals considered for livestock analysis are shown in Table 3 together with their symbols.

1 Memoirs of India Meteorological Department, Volume XXXI, Part 3, 1962.
2-738Agri/76

TABLE 3

Livestock Symbols

Category	Symbol	item	source
cattle : male (over 3 years)	Cm	temperature	Climatological Tables of Observatories in India, India Meteorological Department, 1931—1960 normals
female (over 3 years)	Cf	evapotranspiration	scientific Report No. 136 of the India Meteorological Department, 1971
young stock (under 3 years)	Cy		
buffaloes : male (over 3 years)	Bm	human population	Census of India, 1971
female (over 3 years)	Bf	irrigation and land use statistics	basic data pertaining to land utilisation statistics obtained from the States and refer mostly to 1969-70
young stock (under 3 years)	By		
sheep	S		
goats	G		
horses, mules and ponies	H		
donkeys	D		
camels	Ca		
pigs	P		

The livestock patterns are expressed in coded form in the same manner as the cropping patterns.

Soils

2.11 Soil data on a taluk basis are not available for all the areas of the country. As such, soils have been discussed in a general manner using the traditional nomenclature in describing their characteristics.

Other Data

2.12 The sources of other data featuring in the study are given below :

Item	source
taluk area	States' Census Reports 1971 or from the data furnished by the States in their land-use returns.

item
orography

maps of the Survey of India and National Atlas Organisation

temperature

Climatological Tables of Observatories in India, India Meteorological Department, 1931—1960 normals

evapotranspiration

scientific Report No. 136 of the India Meteorological Department, 1971

human population

Census of India, 1971

irrigation and land use statistics

basic data pertaining to land utilisation statistics obtained from the States and refer mostly to 1969-70

Presentation of Information

2.13 The tables required for following the text are given in the text itself at appropriate places whereas the basic data are appended as follows :

APPENDIX 1

Talukwise Land Use (1969-70) and Population Statistics, (arranged according to State rainfall zones)

APPENDIX 2

Talukwise Livestock Population —1966 (arranged according to State rainfall zones)

APPENDIX 3

Zonewise Information on Rainfall, Rainy days and Cropping Patterns

APPENDIX 4

Zonewise Area under Principal Crops

2.14 Rainfall, cropping and livestock patterns of each State are indicated on maps in the 1.1 million scale and given in Appendices 5, 6 and 7 respectively. In the case of rainfall patterns, the zonal numbers in State maps have been given in Roman numerals and their all-India equivalents as used in Chapter 14 of the Commission's Report have been shown in three digit Arabic numerals within brackets.

3 GENERAL FEATURES

3.1 The geographical area of the State is 55,673 sq km. The area for which complete land-use statistics based on village papers are available is 34,960 sq km. A considerable area in the districts of Lahaul and Spiti, Kinnaur and Mahasu districts has not been cadastrally surveyed and is, therefore, not included in the village papers. Analysis of tehsilwise data on crop, land use etc. is based on areas based

on village papers or reporting area. The above limitation has to be kept in view. There is wide variation in the areas of tehsils of different districts. About 11 tehsils in Kangra, Chamba and Kulu have areas of over 1000 sq km 15 are between 500 and 1000 sq km and the areas of remaining tehsils are less than 500 sq km. The distribution of areas of tehsils is given in Table 4.

TABLE 4
Frequency Distribution of Tehsils according to Areas

District	Total number of tehsils	Number of tehsils with area of				
		Less than or equal to 100 sq km	101—300 sq km	301—500 sq km	501—1000 sq km	Greater than 1000 sq km
Sirmaur	6	—	1	3	2	—
Simla	3	—	1	1	1	—
Bilaspur	2	—	—	—	2	—
Mandi	6	—	—	2	4	—
Kangra	7	—	—	—	2	5
Chamba	5	—	—	—	1	4
Mahasu	11	—	7	3	1	—
Kulu	4	—	—	—	2	2
Kinnaur	6	6	—	—	—	—
Lahul and Spiti	2	2	—	—	—	—
total	*52	8	9	9	15	11

*The total number of tehsils and sub-tehsils is 53 but area figures for Una and Amb in Kangra are combined and hence the data in the table are for 52 tehsils/sub-tehsils.

Orography

3.2 The State is mostly hilly and mountainous with glaciers and eternal snow in the northern and eastern areas. The elevations vary considerably from 0.4 km (Deragopipur) to over 6 km in Chamba, Kulu etc. Kangra, Mandi and Bilaspur have significant areas of lower elevations—less than 1 to 1.5 km (metres above sea-level). Hamirpur and Mandi stations are at elevations of less than 0.8 masl.

Population

3.3 The State has a total population of 3.46 million (1971 census) and an average population density of 62 per sq km. The Table 5 shows the population density of districts. Bilaspur has the highest population density of 167, Kinnaur, Lahul and Spiti have the lowest population density of less than 10. For reasons mentioned above, the density values in the cases of Lahaul and Spiti and Kinnaur and a few other adjoining tehsils do not correctly represent the distribution of population. The density distribution in Chamba, parts of Mandi, Mahasu and Sirmaur varies between 15 to 100, the lower values being mostly in Chamba. In the rest of the tehsils the density is 100 to 200 per sq km except Simla which has the highest density of 558 per sq km.

TABLE 5

Density of Population (per sq km)

District	1961	1971
Mahasu	64	78
Mandi	96	128
Chamba	27	31
Sirmaur	70	87
Bilaspur	136	167
Kinnaur	6	8

TABLE 5 (Contd.)

District	1961	1971
Simla	124	153
Kangra	132	158
Kulu	28	35
Lahaul and Spiti	2	2
State	51	62

Land Use

3.4 The area under forests is 50 per cent of geographical area. Barren and unculturable land, together with land put to non-agricultural uses, accounts for 10 to 25 per cent in Kangra and Bilaspur districts and 34 to 67 per cent in Simla and Kandaghat taluks. Permanent pastures and other grazing land constitute about 20 per cent of State area. Net sown area is small in the State being only 12.6 per cent of geographical area of the State and 18.7 per cent of reporting area. The net sown area is small in the districts of Kinnaur, Kulu and Lahaul and Spiti because these districts the reporting area forms a small percentage of total geographical area. The above mentioned areas have large portions under mountains and snow.

Irrigation

3.5 The net irrigated area in 1968-69 was 17 per cent of net sown area of 549 thousand hectares. Almost the entire irrigation is from other sources with canals, tanks and wells together contributing only one per cent of the total irrigated area. The extent of irrigation of some of the principal crops is indicated in Table 6. Kinnaur and Lahaul and Spiti districts have very little or negligible cropped areas. Fifty per cent of area under rice is irrigated while in the case of wheat only 17% is irrigated. Irrigation is not a major factor in determining the cropping structure of the State.

TABLE 6
Per Cent Area Irrigated under Principal Crops

District	Paddy	Wheat	Barley	Maize	Potato
Bilaspur	33	8	8	2	67
Mahasu	51	8	8	4	5*
Simla	51	21	14	10	8
Sirmur	52	23	26	17	34
Kangra	60	18	19	6	86
Chamba	70	18	11	2	15
Kulu	66	2	—	—	—
Mandi	44	20	5	6	3
State	55	16	9	6	13

*Potato including other vegetables also.

Soils

3.6 Chamba, Lahaul and Spiti, Kulu and Kinnaur districts have sub-montane soils with significant areas under glaciers and snow. In the rest of the State brown hill soils prevail.

Rainfall

3.7 This being a hill State with wide ranging elevations, the distribution of rainfall is naturally affected. The number of rainfall stations is small being seventy and most of the averages are only for a short period of 10 years or less, thereby limiting the scope of study of rainfall distribution. The normal monthly and annual rainfall of the State as a whole is as follows :

	J	F	M	A	M	J	J	A	S	O	N	D	annual
Rf(cm)	11	7	9	5	5	9	36	31	16	8	1	5	143
n	6	4	6	4	4	6	15	14	8	3	0.7	3	73
CV	68	64	71	64	58	61	26	31	67	122	166	88	16

Rf=normal rainfall in cm

n=rainy days. A day on which at least 2.5 mm of rain is recorded is defined as a rainy day

CV=Coefficient of Variation%

3.8 The annual average rainfall in the State varies from less than 50 cm in parts of Lahaul and Spiti to over 300 cm at Dharamsala in Kangra district. The area with rainfall of over 250 cm is Kangra and adjoining Mandi districts followed by Sirmur district with 150 to 200 cm rainfall. The area to the east of the line from Kotkhai in Mahasu district through Kulu to Lahaul gets less than 100 cm rainfall. July and August are the months of heavy rainfall accounting for 50 to 60 per cent of annual rainfall in the southern and western parts of the State. June rainfall accounts for 5 to 10 per cent and September 10 to 15 per cent. Rainfall of the winter months January to March is 20 to 40 per cent of annual in Kinnaur, Chamba and Lahaul and Spiti and 10 to 20 per cent elsewhere.

3.9 For the months of January to May coefficient of variation (CV) in the southern and western portions is 80 to 100 and 60 to 80 elsewhere. June is somewhat similar with CV of 80 to 100. July and August are the雨iest months with CV of 40 in the southern and western half and 40 to 60 or higher in the rest of the state. Coefficient of variation is high from September to December ranging from 80 to 100. The annual CV is 20 to 25 in areas to the south and west of Simla and less than 20 elsewhere. The point to be remembered is that winter rainfall is not dependable due to its high variability and southwest monsoon rainfall is reasonably dependable during July and August.

Temperature

3.10 Tables 7, 8 and 9 show the normals of maximum, minimum and mean daily temperatures of Dalhousie, Dharamsala and Simla which are the only stations for which information is available. It may be relevant to mention here that variation in temperatures with height of stations at elevations 0.9 km. and over follows approximately a lapse rate of 6°C per km.

TABLE 7
Normals of Maximum Daily Temperature (°C)

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Dalhousie	10.9	13.5	17.7	22.8	25.9	27.9	23.7	22.7	23.0	30.8	21.6	18.5	21.6
Dharamsala	14.4	17.1	21.1	25.9	30.8	32.2	27.3	26.3	26.3	24.4	20.7	17.0	23.6
Simla	8.5	10.3	14.4	19.2	23.4	24.3	21.0	20.1	20.0	17.9	15.0	11.3	17.1

TABLE 8
Normals of Minimum Daily Temperature (°C)

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Dalhousie	2.1	4.1	8.0	11.9	15.7	18.1	16.8	16.5	15.4	16.9	11.7	7.8	12.1
Dharamsala	6.5	8.8	12.7	16.7	21.3	22.8	21.2	20.5	19.4	16.1	11.4	8.4	15.5
Simla	1.9	3.1	6.8	11.2	15.0	16.2	15.6	15.2	13.8	10.8	7.3	4.2	10.1

TABLE 9
Normals of Mean Daily Temperature (°C)

Station	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	Annual
Dalhousie	6.5	8.8	12.9	17.4	20.8	23.0	20.3	19.6	19.2	23.9	16.7	13.2	16.9
Dharamsala	10.5	13.0	16.9	21.3	26.1	27.5	24.3	23.4	22.9	20.3	16.1	12.7	19.6
Simla	5.2	6.7	10.6	15.2	19.2	20.3	18.3	17.7	16.9	14.4	11.2	7.8	13.7

4 RAINFALL ZONES, THEIR CROPPING PATTERNS AND LIVESTOCK PATTERNS

4.1 The State is divided into 18 rainfall zones. These are given below together with the number of tehsils included in each and their total approximate area:

<i>Rainfall Zone No.</i>	<i>Rainfall patterns</i>	<i>No. of tehsils with their area in sq km</i>
I	E ₄ (A ₂ B ₁ C ₁) C ₁ D ₁ E ₂	6 (2249)
II	D ₁ E ₃ (A ₁ B ₁ C ₁ E ₁) D ₁ E ₃	2 (1132)
III	D ₁ E ₃ (A ₁ B ₁ C ₁) D ₂ E ₂	6 (2752)
IV	D ₂ E ₂ (C ₂ D ₂) D ₂ E ₂	2 (387)
V	D ₂ E ₂ (B ₁ C ₂ E ₁) D ₂ E ₂	3 (908)
VI	D ₂ E ₂ (B ₂ C ₁ E ₁) D ₂ E ₂	1 (588)
VII	D ₂ E ₂ (A ₂ C ₁ E ₁) D ₁ E ₃	4 (4817)
VIII	D ₂ E ₂ (A ₂ C ₂) D ₁ E ₃	3 (937)
IX	D ₂ E ₂ (A ₂ C ₂) D ₂ E ₂	3 (2115)
X	D ₂ E ₂ (A ₂ B ₁ C ₁) D ₂ E ₂	2 (1266)
XI	D ₃ E ₁ (B ₁ C ₂ E ₁) C ₁ D ₁ E ₂	2 (827)
XII	D ₄ (E ₄) D ₁ E ₃	3 (2619)
XIII	D ₄ (E ₄) C ₁ D ₁ E ₂	4 (70)
XIV	D ₄ (B ₂ C ₁ E ₁) D ₁ E ₃	3 (2715)
XV	C ₁ D ₃ (D ₃ C ₁) E ₁ D ₁ E ₂	1 (28)
XVI	C ₁ D ₃ (B ₁ C ₂ E ₁) C ₂ D ₁ E ₁	2 (2845)
XVII	C ₂ D ₂ (C ₂ D ₂) C ₁ E ₃	3 (4600)
XVIII	C ₂ D ₂ (A ₂ B ₁ C ₁) C ₂ D ₁ E ₁	3 (3105)

Rainfall Zone I—E₄ (A₂ B₁ C₁) C₁ D₁ E₂

4.2 The district, tehsils and the cropping patterns in the zone are :

<i>Cropping Pattern</i>	<i>Tehsil</i>	<i>District</i>
W ₃ M ₄ G ₄ /Pd ₄ 3	Rajgarh	Sirmur
	Pachhad	„
	Paonta Sahib	„
	Shilai	„
	Ranka	„
	Nahan	„

4.3 The area of the zone is 2,249 sq km and has a population density of 109 per sq km. The gross cropped area is 71,300 ha and the net irrigated area is 9,600 ha. Wheat and maize are the principal crops grown in this zone, occupying 24 and 23 per cent respectively.

4.4 In the zone as a whole the population of goats accounts for 23 per cent of livestock, followed by

youngstock, and female cattle with 21 and 17 per cent respectively. The livestock patterns are :

CY₄ Cf₄ Cm₄ G₄ /S₄

G₃ Cy₄ Cf₄ /Cm₄

G₄S₄ Cm₄ Cf₄ /Cy₄

Rainfall Zone II—D₁ E₃ (A₁ B₁ C₁ E₁) D₁ E₃

4.5 The district, tehsils and the cropping patterns in the zone are :

<i>Cropping pattern</i>	<i>Tehsil</i>	<i>District</i>
W ₃ M ₃	Amb	Kangra
	Una	„

4.6 The area of the zone is 1,132 sq. km. and has a population density of 196 per sq. km. The gross cropped area is 55,000 ha out of which only 1100 ha is under irrigation. Wheat is the main crop occupying 43 per cent of cropped area, followed by maize 35 per cent.

4.7 The livestock pattern is Cm₄ Cf₄ Cy₄ G₄/S₄/Bf₄.

Rainfall Zone III—D₁ E₃ (A₁ B₁ C₁ E₁) D₂ E₂

4.8 The districts, tehsils and the cropping patterns in the zone are :

<i>Cropping pattern</i>	<i>Tehsil</i>	<i>District</i>
M ₃ W ₃	Bilaspur Sadar	Bilaspur
	Ghamarwin	„
	Arki	Mahasu
	Solan	„
	Seoni	„
M ₃ W ₄ G ₄	Nalagarh	Simla

4.9 The area of the zone is 2,752 sq km and has an average population density of 140 per sq km. The gross cropped area is 109,800 ha out of which 8,100 ha is under irrigation. Maize occupies 38 per cent of cropped area followed by wheat 33 per cent.

4.10 For the zone as a whole goats account for 23 per cent of livestock population, followed by male cattle (20 per cent), female buffaloes (16 per cent), Sheep (12 per cent) and female cattle (12 per cent). In some taluks male cattle predominate, whereas in others female buffaloes are in large numbers. There are five livestock patterns which are indicated below :

Bf₄ Cm₄ S₄ G₄

Cm₄ Cf₄ Cy₄ S₄ /Bf₄

Cm₄ Cf₄ Cy₄ Bf₄ /S₄ /G₄

G₄ S₄ Cm₄ Cf₄/Cy₄

Cf₄ Cm₄ Cy₄ S₄ /Bf₄ /G₄

Rainfall Zone IV—D₂ E₂ (C₂ D₂) D₂ E₂

4.11 The district, tehsils and the cropping patterns in the zone are :

Cropping pattern	Tehsil	District
W ₃ M ₄ Ba ₄ Mt ₄	Rampur	Mahasu
W ₄ Ba ₄ Mt ₄ M ₄ /Pt ₄ /Pt ₄ Pd ₄	Rohru	„

4.12 The area of the zone is 387 sq km and has an average population density of 309 per sq km. The gross cropped area is 41,000 ha out of which area irrigated is 1300 ha. Wheat is the main crop occupying 29 per cent of the cropped area, followed by small millets (17 per cent) and barley (15 per cent).

4.13 Sheep constitute 38 per cent of the livestock population, with goats, youngstock and female cattle accounting for 20, 15 and 14 per cent respectively. The livestock pattern is S₃ G₄ Cf₄ /Cy₄.

Rainfall Zone V—D₂ E₂ (B₁C₂E₁) D₂ E₂

4.14 The district, taluk and the cropping patterns in the zone are :

Cropping pattern	Taluk	District
W ₃ M ₄ Pt ₄	Theog	Mahasu
Pt ₃ W ₄ M ₄	Kotkhai	„
Fr ₄ W ₄ M ₄	Kumarsain	„

4.15 The area of the zone is 908 sq km and the average population density is 112 per sq km. The gross cropped area is 31600 ha, out of which only 600 ha is under irrigation. Wheat occupies 28 per cent of cropped area, followed by maize (22 per cent), barley and small millets (6 per cent each).

4.16 Female cattle constitute 25 per cent of livestock population followed by youngstock, male cattle 23 per cent and 22 per cent respectively. The livestock pattern is Cf₄ Cm₄ Cy₄ S₄/Bf₄/G₄.

Rainfall Zone VI—D₂ E₂ (B₂ C₁ E₁) D₂ E₂

4.17 The tehsil included in the zone is Karsog of Mandi district and the cropping pattern is W₄ M₄ Pd₄/Ba₅.

4.18 The area of the zone is 588 sq km and the population density is 81 per sq km. The gross cropped area is 19,400 ha out of which only 1,000 ha is under irrigation. Wheat and maize occupy 30 and 20 per cent of the cropped area respectively.

4.19 Goats constitute 22 per cent of the livestock population and female cattle, sheep and goats account for 59 per cent of livestock. The livestock pattern is G₄ S₄ Cm₄ Cf₄/Cy₄/Bf₄.

Rainfall Zone VII—D₂ E₂ (A₂ C₁ E₁) D₁ E₃

4.20 The district, tehsils and the cropping patterns included in the zone are :

Cropping pattern	Tehsil	District
W ₃ M ₄ Pd ₄	Nurpur	Kangra
W ₃ M ₃	Darogopipur	„
	Hamirpur	„
	Badsar	„

4.21 The area of the zone is 4817 sq km and has an average population density of 140 per sq km.

The gross cropped area is 197,500 ha out of which 12,200 ha is under irrigation. Wheat occupies 43 per cent of cropped area and maize 32 per cent.

4.22 Goats constitute 21 per cent of livestock population followed by male cattle (19 per cent), young stock cattle (16 per cent) and female cattle (14 per cent). The livestock patterns are :

G₃ Cm₄ Bf₄/Cf₄/Cy₄
G₄ S₄ Cm₄ Cf₄/Cy₄
Cm₄ Cf₄ Cy₄ G₄/S₄ Bf₄

Rainfall Zone VIII—D₂ E₂ (A₂ C₂) D₁ E₃

4.23 The districts, tehsils and the cropping patterns in the zone are :

Cropping pattern	Tehsil	District
M ₃ W ₃	Kandaghat	Simla
	Kasumpti	Mahasu
W ₃ M ₃	Simla	Simla

4.24 The area of the zone is 937 sq km and has an average population density of 186 per sq km. The gross cropped area is 22,700 ha and 4,400 ha is under irrigation. Maize occupies 41 per cent of cropped area and wheat 32 per cent.

4.25 Male cattle constitute 21 per cent of livestock population, followed by female cattle (21 per cent), young stock cattle (17 per cent) and sheep (17 per cent).

The livestock patterns are :

Cm₄ Cf₄ Cy₄ S₄ /Bf₄
Cf₄ Cm₄ Cy₄ S₄/Bf₄ /G₄

Rainfall Zone IX—D₂ E₂ (A₂ C₂) D₂ E₂

4.26 The district, tehsils and the cropping patterns in the zone are :

Cropping pattern	Tehsil	District
M ₃ W ₃	Sundernagar	Mandi
W ₃ M ₄ Pd ₄ /Ba ₄	Mandi Sadar	„

4.27 The area of the zone is 2115 sq km and the average population density is 132 per sq km. The gross cropped area is 66,000 ha and nearly 5,200 ha is under irrigation. Wheat, maize and paddy are the main crops of the zone occupying 36, 29 and 14 per cent of the cropped area respectively.

4.28 Sheep account for 38 per cent of livestock population, followed by goats (18 per cent), female cattle (13 per cent) and male cattle (12 per cent). The livestock patterns are :

S₃ G₄ Cm₄/Cf₄/Cy₄
S₄ G₄ Cm₄ Cf₄/Cy₄
G₄ S₄ Cm₄ Cf₄ Cy₄ /Bf₄

Rainfall Zone X—D₂ E₂ (A₂ B₁ C₁) D₂ E₂

4.29 The district, tehsils and the cropping patterns in the zone are :

Cropping pattern	Tehsil	District
W ₃ M ₃	Sarkaghat	Mandi
W ₃ M ₄ Pd ₄ /Ba ₄	Joginder Nagar	„

4.30 The area of the zone is 1,266 sq km comprising of only two taluks. It has an average population

goats (14 per cent) and male cattle (14 per cent). The livestock patterns are :

S₃ G₃
S₃ G₄ Cm₄/Cf₄/Cy₄

Rainfall Zone XVII—C₂D₂ (C₂D₂) C₁E₃

4.50 The districts, tehsils and the cropping patterns in the zone are :

Cropping Pattern	Tehsil	District
W ₄ D ₄ Mt ₄	Brahmaur	Chamba
Mt ₃ Ba ₄	Nachhar	Kinnaur
W ₃ M ₄ Ba ₄ /Ea ₄ Pd ₄	Kulu	Kulu

4.51 The area of the zone is 4,600 sq km and has an average population density of 31 per sq km. The gross cropped area is 33,000 ha, but only 2,200 ha is under irrigation. Wheat, maize, millets and barley are the crops cultivated in the zone. Wheat occupies 27 per cent of cropped area followed by maize (21 per cent), small millets (18 per cent) and barley (15 per cent).

4.52 Sheep constitute about 49 per cent of livestock population, with goats (21 per cent) and female cattle (10 per cent). The livestock patterns are :

S₂ G₄
S₂ G₄/Cf₄
S₃ G₄ Cf₄/Cy₄

Rainfall Zone XVIII—C₂ D₂ (A₂ B₁ C₁) C₂ D₁ E₁

4.53 The districts, tehsils and the cropping patterns are :

Cropping pattern	Tehsil	District
W ₃ M ₄ Pd ₄	Palampur	Kangra
M ₃ W ₄ Pd ₄	Kangra	„
	Ahaliyat	Chamba

4.54 The area of the zone is 3,105 sq km and has an average population density of 159 per sq km. The gross cropped area is 109,500 ha. Nearly 30,400 ha of cropped area is irrigated. Wheat, paddy and maize are the principal crops grown, accounting for 36, 28 and 20 per cent of cropped area respectively.

4.55 Male cattle constitute 23 per cent of livestock population, followed by goats (17 per cent), female cattle (16 per cent) and young stock cattle (16 per cent). The livestock patterns are :

Cm₄ Cf₄ Cy₄ G₄/S₄/Bf₄
G₄ S₄ Cm₄ Cf₄/Cy₄

Yield of Principal Crops

4.56 In view of non-availability of detailed information on yield of crops according to zones, the Relative Yield Index values of crops, (district-wise) are indicated in Table 10. The wheat yields are low, ranging from 58 to 88 in the various districts, because the crop is partly irrigated. The State average is only 70 per cent of all-India level. The yields of rice, maize, small millets and barley are quite good, the State average being above all-India level. The yield of gram, pulses and potato is low.

TABLE 10

Districtwise Relative Yield Index of Principal Crops

District	Rice	Maize	Small millets	Wheat	Barley	Gram	Pulses	Potato
Bilaspur	99	136	—	70	—	78	72	—
Chamba	89	183	—	58	95	—	64	—
Kangra	108	136	—	65	63	72	68	—
Kulu	103	253	180	78	145	—	92	46
Kinnaur	—	—	107	81	121	—	—	—
Lahaul and Spiti	—	—	—	—	—	—	—	—
Mahasu	88	193	269	67	151	—	57	58
Mandi	105	199	—	88	107	—	79	4
Simla	92	148	—	65	245	132	159	—
Sirmur	91	123	—	68	73	—	77	—
State	103	161	226	70	121	89	79	55

NOTE: Relative Yield Index represents district/State yield expressed as percentage of the corresponding all-India average yield for 1968-69 to 1970-71.

5 FUTURE CROPPING PATTERNS—SOME OBSERVATIONS

General

5.1 In the foregoing sections we have dealt with in detail the rainfall, cropping and livestock patterns which emerge from the existing information. We have also categorised the rainfall patterns into zones and discussed how the other patterns feature in those zones. Among other information that on soils, which ought to play an important role in determining cropping patterns, is lacking in such details as are wanted for this analysis. Data on orography and population density have featured in this analysis but their exact role on cropping and livestock patterns could not be brought out owing to lack of detailed information. We are, however, convinced that studies and analysis indicated in preceding sections are important for the guidance they may give in deciding cropping and livestock patterns vis a vis rainfall patterns. The greater the accuracy of the primary information, and the more detailed such information is, the more useful the data would be in drawing up the most efficient cropping and livestock patterns in an area or a zone. With this purpose in view the following procedures are suggested :

- (i) Delineation of rainfall zones;
- (ii) Identification of the existing cropping patterns;
- (iii) Assessment of area needed for each crop and its ideal distribution;
- (iv) Comparison of (iii) with (ii) in order to determine possible changes; and
- (v) Consideration of other related factors like soil, irrigation facilities, density of population, livestock patterns and then arriving at the future cropping patterns.

5.2 The methods of delineating rainfall patterns or zones and cropping patterns have been fully discussed in Section 2. For the purpose of locating suitable areas for a crop, soil and topography of the land are important factors. The approximate area to be put under each crop will be decided by the demand for it not only at a State level but at the national level, either for internal consumption or for the purpose of export. The departments responsible for crop planning of a State should, therefore, be cognisant of the demand for a crop, so that production efforts are not rendered futile because of lack of demand and marketing. We have already discussed the part each of the factors mentioned in item (v) in para 5.1 is likely to play in deciding cropping patterns. For this purpose not only detailed data but also knowledge about the correlation between these factors and crop performance would be necessary. Knowledge gained, through long experience, by farmers would also be most helpful.

5.3 We ought to mention that the rainfall intervals which form the basis of identifying rainfall patterns are subject to minor modifications. Thus, the condition that 30 cm of rainfall for three consecutive months is good for paddy may not be rigorously

adhered to. If the soil is favourable with a high water retention capacity or, what is more important, water management is efficient and economic, rainfall lower than 30 cm for three months may sustain a good crop of paddy.

5.4 The choice of a cropping pattern is not decided by the farmer only on technical grounds. He is also guided by the profitability of the crops of requirements for his household consumption. Farmers may not be inclined to accept a crop unless the necessary inputs and infrastructure are assured. Of all the inputs water is the most important as is made evident by the spread of groundnut in the country, sugarcane in Gujarat, maize and cotton in Karnataka and recently of wheat in West Bengal. These are excellent instances of the manner of introduction of new crops in the cropping patterns of a State or a region.

Some Observations pertaining to Himachal Pradesh

5.5 The following extracts from Chapter 59 on Special Area Development Programmes are relevant to Himachal Pradesh :

“Broadly, the Himalayan hill terrain consists of steep hills and narrow valleys. The soils are liable to rapid erosion unless complete vegetative cover is provided. On the steep slopes, except where terracing is possible, the best cover is forests. In certain hills, where the soil cover is poor, the best cover is grass. Hence a substantial part of the terrain is economically suited to, and also ecologically requires, either a forestry programme or a pasture development programme. Cultivation of crop is possible only in the valleys and on terraced farm up a hill slope. Such land being limited, the most valuable crops should be grown. The terrain can support horticulture for which even slopes can be used. Being suited to grow fruits of the temperate regions like apples, pears, peaches, plums, etc., which command a very lucrative market in the tropical plains, horticulture gives the maximum return per unit of land..... If a suitable production programme, which will optimise the economic return to the population is to be adopted, it may be necessary to make alternative arrangements to provide foodgrains through controlled channels from other parts of the country. This is being done even now in Jammu & Kashmir, though the State has been emphasising the production of foodgrains programme for agricultural lands. The pattern of agriculture, which has developed in Kerala, with similar constraints of terrain, can be a pointer. Kerala has opted, by trial, for a plantation economy and thereby has increased the per

hectare return in agriculture. At the same time, the nation, which requires the plantation crops, has taken the responsibility for feeding the population of Kerala. A rational land use pattern for maximising production and productivity of land leads thus to a national food production and distribution responsibility. Taking too narrow review of the responsibility for food can lead to the hill areas remaining backward and finding it difficult to support economically its growing population." (vide paragraphs Nos. 59.2.13 and 59.2.14, Chapter 59 of the main Report).

5.6 Himachal Pradesh has to concentrate chiefly on fruit crops, among which walnut is a promising foreign exchange earner. Its area could be easily doubled in the State. The State has already specialised in the production of seed of many kinds of vegetables and flowers and this activity could be expanded further. The State is also in a position to produce off-season vegetables in a big way for

supply to the plains. It is also suited for growing sugarbeet for the manufacture of sugar.

5.7 Among field crops the State could specialise in the production of some of the pulses typical to the mountainous regions. Particular mention might be made of the indigenous variety of soyabean (bhatwas) which is grown in the Garhwal region. It has lower oil content than the exotic varieties. The local variety would have an edge over other popular varieties.

5.8 Himachal Pradesh has played a big role in the supply of potato seed to other parts of the country. The yield of potato in the State is, however, poor and requires to be improved. Increased yield is also necessary for reducing the pressure on land for growing potatoes to cater to the increasing demand.

5.9 It is also necessary to encourage fodder production wherever possible. In hills natural grasses can easily be grown and their productivity improved through seeding and fertilisation. The orchards in Himachal Pradesh could also take up growing grasses, preferably leguminous varieties. Legume fodders could also be included in field crop rotations.



APPENDIX 1
Talukwise Land Use (1969-70) and Population Statistics

HIMACHAL PRADESH

(thousand hectares)

District/taluk	Population 1971		forests	nac	cw	pp & gl	mtc & g	fallow lands	net area sown
	total	density per sq km							
	<i>Rainfall Zone—I</i>						<i>Rainfall Pattern—E₄ (A₂B₁C₁) C₁D₁E₂</i>		
Sirmaur									
Rajgarh	24,992	61	22	3	8	17	20	1	11
Pachhad	25,546	62	(27)	(4)	(9)	(21)	(25)	(1)	(13)
Paonta Sahib	81,157	219	2	6	2	8	3	1	14
Rainka	38,931	72	20	4	3	33	13	1	12
Shilai	34,335	106	(23)	(5)	(3)	(39)	(15)	(1)	(14)
Nahan	40,072	209	3	2	2	6	1	1	4
	<i>Rainfall Zone—II</i>						<i>Rainfall Pattern—D₁E₃ (A₁B₁C₁E₁) D₁E₃</i>		
Kangra									
Amb	2,22,009	196	12	30	34	1	—	3	34
Una			(10)	(27)	(30)	(1)	(—)	(2)	(30)
	<i>Rainfall Zone—III</i>						<i>Rainfall Pattern—D₁E₃ (A₁B₁C₁E₁) D₂E₂</i>		
Bilaspur									
Bilaspur Sadar	75,048	138	5	8	1	28	—	1	12
			(9)	(14)	(2)	(51)	(—)	(2)	(22)
Ghamarwin	119,738	196	7	11	2	21	—	1	18
			(12)	(19)	(4)	(35)	(—)	(1)	(30)
Mahasu									
Arki	46,816	119	7	2	1	20	—	0.4	9
			(18)	(5)	(2)	(51)	(—)	(1)	(23)
Seoni	22,274	93	5	1	0.4	13	—	0.2	4
			(21)	(4)	(2)	(54)	(—)	(1)	(18)
Solan	45,460	177	3	3	1	14	—	0.3	5
			(10)	(10)	(5)	(53)	(—)	(1)	(21)
Simla									
Nalagarh	77,095	109	10	9	—	—	—	33	19
			(14)	(12)	(—)	(—)	(—)	(47)	(27)
	<i>Rainfall Zone—IV</i>						<i>Rainfall Pattern—D₂E₂ (C₂D₂) D₂E₂</i>		
Mahasu									
Rampur	56,788	334	—	1	2	1	—	1	11
			(—)	(6)	(13)	(8)	(—)	(6)	(67)
Rohru	62,910	290	—	1	5	0.3	—	2	14
			(—)	(4)	(21)	(1)	(—)	(10)	(64)
	<i>Rainfall Zone—V</i>						<i>Rainfall Pattern—D₂E₂ (B₁C₂E₁) D₂E₂</i>		
Mahasu									
Kumarsain	30,809	134	6	2	0.4	10	0.2	1	5
			(25)	(7)	(2)	(42)	(1)	(2)	(21)

— = nil or negligible
 nac = not available for cultivation
 cw = culturable waste
 pp&gl = permanent pastures and other grazing lands
 mtc&g = miscellaneous tree crops and groves not included in net area sown

NOTE : Figures in brackets represent percentages to total reporting area,

APPENDIX 1 (Contd.)

District/taluk	Population 1971		forests	nac	cw	pp&gl	mtc&g	fallow lands	(thousand hectares)	
	total	density per sq km							net area sown	
Kotkhai	24,285	121	4 (20)	1 (5)	1 (3)	9 (45)	0·1 (1)	0·4 (2)	5 (24)	
Theog	47,237	99	7 (15)	3 (6)	1 (2)	26 (54)	2 (4)	1 (1)	9 (18)	
	<i>Rainfall Zone—VI</i>		..	..	..	<i>Rainfall Pattern—D₂E₂</i>		<i>(B₂C₁E₁)</i>	<i>D₂E₂</i>	
Mandi Karsog	47,906	81	22 (38)	3 (4)	1 (1)	20 (35)	— (—)	0·3 (1)	12 (21)	
	<i>Rainfall Zone—VII</i>		..	..	..	<i>Rainfall Pattern—D₂E₂</i>		<i>(A₂C₁E₁)</i>	<i>D₁E₂</i>	
Kangra Nurpur	1,55,483	116	52 (39)	26 (20)	12 (9)	1 (1)	— (—)	10 (7)	33 (24)	
Deragopipur	2,13,458	166	20 (16)	35 (28)	24 (19)	7 (5)	— (—)	10 (8)	32 (24)	
Hamirpur	2,10,985	138	41 (27)	37 (24)	13 (8)	5 (3)	— (—)	12 (8)	46 (30)	
Badsar	93,354	141	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	— (—)	
	<i>Rainfall Zone—VIII</i>		..	..	..	<i>Rainfall Pattern—D₂E₂</i>		<i>(A₂C₂)</i>	<i>D₁E₃</i>	
Shimla Simla	72,002	558	1 (8)	4 (34)	— (—)	— (—)	— (—)	4 (34)	3 (24)	
Kandaghat	68,032	153	0·4 (1)	31 (69)	— (—)	— (—)	— (—)	1 (3)	12 (27)	
Mahasu Kasumpti	34,937	97	7 (20)	2 (6)	1 (3)	21 (57)	— (—)	0·3 (1)	5 (13)	
	<i>Rainfall Zone—IX</i>		..	..	..	<i>Rainfall Pattern—D₂E₂</i>		<i>(A₂C₂)</i>	<i>D₂E₂</i>	
Mandi Sunder Nagar	73,510	169	13 (29)	3 (6)	0·4 (1)	19 (43)	— (—)	— (—)	9 (21)	
Mandi Sadar	1,34,711	164	36 (44)	5 (6)	1 (1)	21 (25)	— (—)	— (—)	19 (24)	
Chichot	71,891	84	37 (44)	3 (4)	— (—)	31 (36)	— (—)	1 (1)	13 (15)	
	<i>Rainfall Zone—X</i>		..	..	..	<i>Rainfall Pattern—D₂E₂</i>		<i>(A₂B₁C₁)</i>	<i>D₂E₂</i>	
Mandi Sarkaghat	1,02,698	211	4 (8)	5 (10)	1 (2)	22 (45)	— (—)	— (—)	17 (35)	
Joginder Nagar	84,464	108	35 (45)	4 (5)	1 (1)	23 (30)	— (—)	1 (1)	14 (18)	
	<i>Rainfall Zone—XI</i>		..	..	..	<i>Rainfall Pattern—D₃E₁</i>		<i>(B₁C₂E₁)</i>	<i>C₁D₁E₂</i>	
Mahasu Jubbai	26,857	90	8 (32)	1 (5)	1 (3)	10 (41)	— (—)	0·4 (2)	4 (7)	
Chaupal	46,745	80	11 (19)	5 (8)	1 (2)	33 (56)	— (—)	1 (1)	9 (15)	
	<i>Rainfall Zone—XII</i>		..	..	..	<i>Rainfall Pattern—D₄</i>		<i>(E₄)D₁E₃</i>		
Lahaul and Spiti Spiti	7,196	554*	— (—)	0·2 (15)	— (3)	— (—)	— (—)	0·1 (10)	1 (72)	
Lahaul	16,342	430*	— (—)	1 (15)	0·1 (2)	2 (41)	0·1 (4)	— (—)	1 (38)	

*These densities have been calculated from reported areas according to geographical area, density for Lahaul & Spiti district is

APPENDIX 1 (Concl'd.)

(thousand hectares)

District/taluk	Population 1972		forest	nac	cw	pp&gl	mtc&g	fallow lands	net area sown
	total	density per sq km							
Chamba									
Pangi	13,824	39	34 (9)	3 (1)	0·1 (—)	317 (89)	— (—)	0·4 (0·1)	2 (1)
<i>Rainfall Zone—XIII</i>									
Kinnaur			..	..	..	
Hangrang	3,125	446	— (—)	0·1 (9)	0·1 (8)	0·2 (27)	— (—)	0·1 (8)	0·3 (48)
Pooh	5,841	307	— (—)	1 (35)	0·2 (11)	0·4 (20)	— (—)	0·1 (5)	1 (29)
Morang	7,447	355	— (—)	0·2 (10)	0·1 (6)	0·3 (15)	— (—)	0·2 (13)	1 (56)
Kalpa	10,789	469	— (—)	0·2 (9)	0·2 (7)	0·1 (5)	— (—)	0·2 (11)	2 (68)
<i>Rainfall Zone—XIV</i>			..	..	..	
Kulu									
Banjar	34,346	26	42 (32)	2 (1)	1 (1)	69 (60)	— (—)	1 (1)	7 (5)
Ani	26,439	31	12 (14)	1 (1)	— (—)	66 (78)	— (—)	0·4 (1)	5 (6)
Nirmand	28,621	52	17 (30)	2 (3)	— (—)	31 (55)	— (—)	1 (2)	6 (10)
<i>Rainfall Zone—XV</i>			..	..			
Kinnaur									
Sangla	8,428	301	— (—)	0·3 (11)	0·3 (12)	0·4 (13)	— (—)	0·2 (8)	2 (56)
<i>Rainfall Zone—XVI</i>			..	..			
Chamba									
Chamba	83,102	65	13 (10)	4 (3)	1 (1)	96 (76)	— (—)	— (—)	13 (10)
Chaurah	67,093	44	23 (14)	4 (3)	3 (2)	116 (74)	— (—)	1 (—)	11 (7)
<i>Rainfall Zone—XVII</i>			..	..	..	
Kulu									
Kulu	1,02,965	38	35 (13)	4 (2)	1 (—)	22 (79)	— (—)	1 (—)	16 (6)
Chamba									
Brahmaur	27,067	15	20 (11)	3 (2)	— (—)	154 (85)	— (—)	1 (—)	4 (2)
<i>Rainfall Zone—XVIII</i>			..	..	..	
Kinnaur									
Nachhar	14,205	338	— (—)	0·3 (7)	0·4 (9)	0·2 (5)	— (—)	0·3 (7)	3 (72)
<i>Rainfall Zone—XIX</i>			..	..	..	
Kangra									
Palampur	2,24,508	167	64 (48)	20 (15)	15 (11)	5 (3)	— (—)	1 (1)	29 (22)
Kangra	2,07,414	190	65 (60)	15 (13)	2 (2)	3 (3)	— (—)	2 (2)	22 (20)
Chamba									
Bhattiyat	64,147	96	17 (26)	4 (6)	2 (3)	34 (51)	— (—)	— (—)	9 (14)

APPENDIX 2
Talukwise Livestock Population—1966
HIMACHAL PRADESH

(thousands)

District/taluk	Cattle			Buffaloes			Sheep			Goats		Horses	Mules	Donkeys	Camels	Pigs	Total
	m	f	ys	m	f	ys				&	ponies						live- stock
	<i>Rainfall Zone—I</i>						..	..		<i>Rainfall Pattern—E₄ (A₂ B₁ C₁) C₁ D₁ E₂</i>						
Sirmaur																	
Rajgarh	18	20	23	—	7	4	13	14	1	1	—	—	—	—	—	101	
Pachhad	(18)	(20)	(23)	(—)	(7)	(4)	(13)	(14)	(1)	(1)	(—)	(—)	(—)	(—)	(—)		
Paonta Sahib	19	14	18	—	6	3	8	21	—	—	—	—	—	—	—	90	
	(21)	(16)	(20)	(—)	(6)	(4)	(9)	(24)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Rainka	22	25	33	—	4	2	26	40	neg	neg	—	—	—	—	—	152	
Shilai	(15)	(16)	(22)	(—)	(3)	(1)	(17)	(26)	(neg)	(neg)	(—)	(—)	(—)	(—)	(—)		
Nahan	7	8	9	—	2	1	2	16	—	—	—	—	—	—	—	46	
	(16)	(17)	(19)	(—)	(5)	(3)	(4)	(36)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
	<i>Rainfall Zone II</i>						..	..		<i>Rainfall Pattern—D₁ E₃ (A₁ B₁ C₁ E₁) D₁ E₃</i>						
Kangra																	
Amb							na										
Una							na										
	<i>Rainfall Zone III</i>						..	..		<i>Rainfall Pattern—D₁ E₃ (A₁ B₁ C₁ E₁) D₂ E₂</i>						
Bilaspur																	
Bilaspur Sadar	14	6	4	—	13	5	8	18	—	—	—	—	—	—	—	69	
	(21)	(9)	(6)	(—)	(19)	(7)	(11)	(27)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Ghamarwin	25	5	4	—	24	11	18	15	—	—	—	—	—	—	—	102	
	(24)	(5)	(4)	(—)	(24)	(11)	(17)	(15)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Mahasu																	
Arki	13	13	10	—	8	2	8	7	—	—	—	—	—	—	—	61	
	(21)	(21)	(16)	(—)	(13)	(3)	(14)	(12)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Seoni	8	10	8	—	3	1	6	6	—	—	—	—	—	—	—	42	
	(19)	(24)	(20)	(—)	(7)	(2)	(14)	(14)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Solan	8	7	5	—	5	2	6	13	—	—	—	—	—	—	—	47	
	(18)	(14)	(11)	(—)	(11)	(4)	(14)	(28)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Simla																	
Nalagarh	17	8	8	—	15	8	3	35	—	—	—	—	—	—	—	94	
	(18)	(9)	(9)	(—)	(16)	(8)	(3)	(37)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
	<i>Rainfall Zone IV</i>						..	..		<i>Rainfall Pattern—D₂ E₂ (C₂ D₂) D₂ E₂</i>						
Mahasu																	
Rampur	12	15	17	—	1	—	35	20	—	—	—	—	—	—	—	100	
	(12)	(15)	(17)	(—)	(1)	(—)	(35)	(20)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Rohru	12	15	15	—	1	—	44	21	—	—	—	—	—	—	—	109	
	(11)	(14)	(14)	(—)	(1)	(—)	(41)	(19)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
	<i>Rainfall Zone V</i>						..	..		<i>Rainfall Pattern—D₂ E₂ (B₁ C₂ E₁) D₂ E₂</i>						
Mahasu																	
Kumarsain	7	8	9	—	0.3	—	7	5	—	—	—	—	—	—	—	37	
	(19)	(22)	(25)	(—)	(1)	(—)	(19)	(14)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Kotkhai	7	7	7	—	1	0.2	3	2	—	—	—	—	—	—	—	27	
	(26)	(26)	(26)	(—)	(3)	(1)	(11)	(7)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Theog	17	20	17	—	2	0.4	12	7	1	—	—	—	—	—	0.1	77	
	(22)	(26)	(22)	(—)	(3)	(1)	(16)	(9)	(1)	(—)	(—)	(—)	(—)	(—)	(0.1)		

m=male

f=female

ys=youngstock

—=nil or negligible

Note : Figures in brackets represent percentage to total livestock population.

APPENDIX 2 (Contd.)

(thousands)

District/taluk	Cattle			Buffaloes			Sheep		Goats	Horses	Mules	Donkeys	Camels	Pigs	Total live-stock
	m	f	ys	m	f	ys			& ponies						
<i>Rainfall Zone—VI</i>															
Mandi							..	..					
Karsog	18	23	21	—	2	1	21	24	—	—	—	—	—	—	111
	(16)	(21)	(19)	(—)	(2)	(1)	(19)	(22)	(—)	(—)	(—)	(—)	(—)	(—)	
<i>Rainfall Zone—VII</i>							..	..					
Kangra															
Nurpur	26	27	34	6	14	11	11	44	2	0.2	—	0.1	—	—	176
	(15)	(15)	(20)	(3)	(8)	(7)	(6)	(25)	(1)	(0.1)	(—)	(0.1)	(—)	(—)	
Deragopipur	44	23	25	3	25	16	20	33	1	—	—	—	—	—	190
	(23)	(12)	(13)	(2)	(13)	(9)	(11)	(17)	(—)	(—)	(—)	(—)	(—)	(—)	
Hamirpur	0.4	0.2	0.2	—	0.4	0.2	0.1	1	—	—	—	—	—	—	2.3
	(20)	(8)	(8)	(—)	(18)	(7)	(3)	(36)	(—)	(—)	(—)	(—)	(—)	(—)	
Badsar	na														
<i>Rainfall Zone—VIII</i>							..	..					
Simla															
Simla	4	4	3	—	3	1	4	1	—	—	—	—	—	—	20
	(20)	(22)	(16)	(—)	(15)	(4)	(19)	(4)	(—)	(—)	(—)	(—)	(—)	(—)	
Kandaghat	16	15	12	—	9	4	12	8	—	—	—	—	—	—	76
	(21)	(20)	(16)	(—)	(12)	(5)	(16)	(10)	(—)	(—)	(—)	(—)	(—)	(—)	
<i>Rainfall Zone—IX</i>							..	..					
Mandi															
Sunder Nagar	12	11	9	—	8	4	15	18	—	—	—	—	—	—	79
	(16)	(14)	(12)	(—)	(11)	(5)	(19)	(23)	(—)	(—)	(—)	(—)	(—)	(—)	
Mandi Sadar	24	25	22	—	14	6	122	34	1	—	—	—	—	—	248
	(10)	(10)	(9)	(—)	(6)	(2)	(49)	(14)	(—)	(—)	(—)	(—)	(—)	(—)	
Chichot	19	25	21	—	1	—	39	29	—	—	—	—	—	—	134
	(14)	(18)	(16)	(—)	(1)	—	(29)	(22)	(—)	(—)	(—)	(—)	(—)	(—)	
<i>Rainfall Zone—X</i>							..	..					
Mandi															
Sarkaghat	24	13	10	—	20	6	26	27	—	—	—	—	—	—	125
	(19)	(10)	(8)	(—)	(16)	(5)	(21)	(21)	(—)	(—)	(—)	(—)	(—)	(—)	
Joginder Nagar	24	26	24	—	9	4	37	42	—	—	—	—	—	—	168
	(14)	(16)	(14)	(—)	(6)	(3)	(22)	(25)	(—)	(—)	(—)	(—)	(—)	(—)	
<i>Rainfall Zone—XI</i>							..	..					
Mahasu															
Jubbal	4	7	20	—	1	—	29	28	—	—	—	—	—	—	91
	(5)	(8)	(22)	(—)	(1)	(—)	(32)	(32)	(—)	(—)	(—)	(—)	(—)	(—)	
Chaupal	13	18	6	—	0.3	—	8	5	—	—	—	—	—	—	51
	(26)	(35)	(12)	(—)	(1)	(—)	(16)	(10)	(—)	(—)	(—)	(—)	(—)	(—)	
<i>Rainfall Zone—XII</i>							..	..					
Lahaul and Spiti															
Spiti	—	1	0.1	—	—	—	3	4	1	0.1	2	—	—	—	11
	(—)	(9)	(1)	(—)	(—)	(—)	(26)	(36)	(9)	(1)	(18)	(—)	(—)	(—)	
Lahaul	1	3	1	—	—	—	32	2	0.4	—	—	—	—	—	39
	(3)	(8)	(3)	(—)	(—)	(—)	(80)	(5)	(1)	(—)	(—)	(—)	(—)	(—)	
<i>Chamba</i>															
Pangi	2	5	2	—	—	—	23	6	—	—	—	—	—	—	38
	(5)	(15)	(4)	(—)	(—)	(—)	(61)	(15)	(—)	(—)	(—)	(—)	(—)	(—)	

APPENDIX 2 (Concl.)

APPENDIX 3
Rainfall and Cropping Patterns
HIMACHAL PRADESH

Cropping patterns	District/taluk	Geographical area (sq km)	Elevation (masl)	Annual rainfall				*Consecutive Months						
				max	min	total	rd	mmr	mr	nd	a			
	Rainfall Zone—I	Rainfall Pattern—E₄ (A₂B₁C₁) C₁D₁E₂							
	Sirmaur													
W ₃ M ₃ G ₄ /Pd ₄	Rajgarh	412	3647	2180	—	—	—	—	—	—	—	—	—	
	Pachchad	408	2962	1533	160	70	7	90	34	6—5	133	52		
	Paontesahib	372	2589	662	199	66	8/	129	35	6—5	178	53		
	Rainika	542	3647	1533	176	64	7	99	31	6—5	149	49		
	Shilai	323	3647	2589	—	—	—	—	—	—	—	—		
	Nahan	192	1533	662	175	64	8/	110	34	7—3	132	43		
	Rainfall Zone—II	Rainfall Pattern—D₁E₃ (A₁B₁C₁E₁) D₁E₃							
	Kangra													
W ₃ M ₃	Amb }	1132	1018	570	—	102	49	7	58	23	7—3	72	29	
	Una }		650	570	—	—	—	—	—	—	—	—	—	
	Rainfall Zone—III	Rainfall Pattern—D₁E₃ (A₁B₁C₁E₁) D₂E₂							
	Bilaspur													
M ₃ W ₃	Bilaspur Sadar	545	1187	916	130	62	7	72	28	7—3	91	37		
	Ghamarwin	610	1187	916	—	—	—	—	—	—	—	—		
	Mahasu													
	Arki	394	na	2069	121	60	7	63	26	7—3	76	33		
	Seone	240	3187	2205	106	60	7	54	26	7—3	64	32		
	Solan	257	2180	1927	159	68	7—8	76	31	6—4	110	45		
M ₃ W ₄ G ₄	Simla	—	—	—	—	—	—	—	—	—	—	—		
	Nalagarh	706	2069	479	—	—	—	—	—	—	—	—		
	Rainfall Zone—IV	Rainfall Pattern—D₂E₂ (C₂D₂) D₂E₂							
	Mahasu													
W ₃ M ₄ Ba ₄ Mt ₄ W ₄ Ba ₄ Mt ₄ M ₄ /Pt ₄ /Pt ₄ Pd ₄	Rampur	170	5773	3187	82	61	7	32	23	7—2	32	23		
	Rohru	217	5240	3187	97	71	7	35	26	7—3	46	33		
	Rainfall Zone—V	Rainfall Pattern—D₂E₂ (B₁C₂E₁) D₂E₂							
	Mahasu													
Fr ₄ W ₄ M ₄ Pt ₃ W ₄ M ₄ W ₃ M ₄ Pt ₄	Kumar sain	230	na	3187	102	65	7	41	22	7—3	51	28		
	Kotkhai	201	3187	na	98	70	7	40	27	7—3	51	33		
	Theog	477	3187	2188	—	—	—	—	—	—	—	—		
	Rainfall Zone—VI	Rainfall Pattern—D₂E₂ (B₂C₁E₁) D₂E₂							
	Mandi													
W ₄ M ₄ Pd ₄ /Ba ₅	Karsog	588	3356	na	112	65	7	54	27	7—3	65	34		
	Rainfall Zone—VII	Rainfall Pattern—D₂E₂ (A₂C₁E₁) D₁E₃							
	Kangra													
W ₃ M ₄ Pd ₄	Nurpur	1344	na	na	152	63	8/	91	30	7—3	108	36		
W ₃ M ₃	Deragopipur	1283	1134	436	134	61	8/	80	29	7—3	96	35		
	Hamirpur	1529	1162	768	137	67	8/	83	32	7—3	99	38		
	Badsar	661	1162	768	—	—	—	—	—	—	—	—		

masl=metres above sea level rd=rainy days mmr=month of maximum rainfall

mr=total rainfall of mmr plus that of preceding or following month, whichever is higher, in cm.

nd=number of rainy days of mmr plus that of preceding or following month, whichever has higher rainfall.

*Consecutive months with rainfall of more than 10 cm per month.

a=Initial month with more than 10 cm of rainfall and number of consecutive months with more than 10 cm/month, separated by hyphen.

b=Total rain all of consecutive months under 'a' in cm.

c=Total number of rainy days of consecutive months under 'a'.

na=not available.

NOTES : 1. Information on rainfall and rainy days are based on the Memoirs of India Meteorological Department, Vol. XXXI, Part III as on 12th May, 1961.

2. For explanation of coded form of rainfall and cropping patterns, reference may be made to section 2 in the text.

APPENDIX 3 (Contd.)

Cropping patterns	District/taluk	Geogra- phical area (sq km)	Elevation (masl)		Annual rainfall					*Consecutive Months		
			max	min	total	rd	mmr	mr	nd	a	b	c
Rainfall Zone—VIII												
W₃M₃	Simla		..	..	..				
M₃W₃	Simla	129	2205	2180	153	89	7—8	83	40	6—4	116	59
	Kandaghat	446	2189	1927				na				
Mahasu												
	Kasumpti	362	2205	2180	151	85	7	84	38	7—3	104	49
Rainfall Zone—IX												
M₃W₃	Mandi		..	..	..				
	Sundernagar	435	3356	916	176	82	7	97	36	6—4	132	53
W₃M₄ Pd₄/Ba₄	Mandi Sadar	820	3478	754	165	80	7	98	37	6—4	129	53
	Chichot	860	3356	916	175	82	7	100	36	6—4	131	53
Rainfall Zone—X												
W₃M₃	Mandi		..	..	..				
W₃M₄Pd₄/Ba₄	Sarkaghat	487	916	754	216	74	8	122	34	6—5	178	53
	Joginder Nagar	779	3478	754	233	90	8—7	135	40	6—4	182	59
Rainfall Zone—XI												
M₃W₃	Mahasu		..	..	..				
W₄Ba₄Mt₄M₄/Pt₄/Pt₄pd₄	Jubbal	243	3940	3191	110	67	7	43	24	7—3	54	30
	Chaupal	584	3647	2589	129	77	7	49	29	7—4	75	39
Rainfall Zone—XII												
Ba₂ Pu₄/W₄	Lahaul and Spiti		..	..	..				
Ba₃ Mt₄ W₄	Spiti	13	4891	4802	55	49	3	18	14	—	—	—
	Lahaul	38	4891	na								
Mt Ba₄	Chamba											
	Pangi	3568	6279	na				na				
Rainfall Zone—XIII												
Ba₃ Mt₄ W₄	Kinnaur		..	..	..				
	Hangrang	7	5773	5240				na				
Mt₃ Ba₄	Pooh	19	5773	5240				na				
	Morang	21	5773	5240				na				
	Kalpa	23	5773	5240				na				
Rainfall Zone—XIV												
W₃M₄Ba₄/Ba₄ Pd₄	Kulu		..	..	..				
	Banjar	1311	5167	4802	112	82	7—8	46	30	6—4	67	45
	Ani	851	5167	4802			na					
	Nirmand	553	5167	4802			na					
Rainfall Zone—XV												
Mt₁	Kinnaur		..	..	..				
	Sangla	28	5773	5240	105	68	1—2	36	15	12—4	60	27
Rainfall Zone—XVI												
M₂ W₄	Chamba		..	..	..				
	Chaurah	1272	na	na	130	71	7	43	25	7—4	65	33
								na				
Rainfall Zone—XVII												
W₃M₄Ba₄/Ba₄Pd₄	Kulu		..	..	..				
	Kulu	2740	6248	1217	98	69	8	27	20	7—2	27	20
									35			
Chamba												
W₄ M₄ Mt₄	Brahmaur	1818	na	na	133	78	8	35	25	7—4	67	38
									36			
Kinnaur												
Mt₃ Ba₄	Nachhat	42	5773	5240	100	78	7—8	29	19	7—3	40	32
Rainfall Zone—XVIII												
W₃M₄Pd₄	Kangra		..	..	..				
	Palampur	1344	na	919	268	97	8	168	44	6—4	213	64
									35			
Kangra												
	Chamba	1093	na	1134	196	75	8	127	36	6—4	160	50
M₃W₄Pd₄	Bhattiyat	668	na	na				na				

APPENDIX 4

Area under Prinicpal Crops-1969-70

HIMACHAL PRADESH

(Thousand hectares)

NOTES: 1. Figures in brackets represent percentages to gross cropped area.
2. The percentage figures have been rounded off individually and hence

APPENDIX 4 (Contd.)

District/taluk	Gross crop- prod- area	Pd	Jk	Jr	B	M	R	W	Ba	Mt	G	T	Pu	S	Gn	O	C	L	F	Misc.
<i>Rainfall Zone—IV</i>																				
Mahasu																				
Rampur	20	2	—	—	—	—	—	2	1	7	3	3	—	—	—	—	—	—	—	
	(8)	(—)	(—)	(—)	(—)	(—)	(—)	(9)	(3)	(37)	(14)	(15)	(—)	(—)	(—)	(—)	(—)	(—)	1	
Rohtu	21	1	—	—	—	—	—	1	2	5	3	4	—	1	—	—	—	—	—	
	(5)	(—)	(—)	(—)	(—)	(—)	(—)	(5)	(10)	(24)	(15)	(19)	(—)	(5)	(—)	(—)	(—)	(—)	4	
<i>Rainfall Zone—V</i>																				
Mahasu																				
Kumarsain	10	0.4	—	—	—	—	—	2	0.1	3	0.2	1	—	—	1	—	—	—	—	
	(5)	(—)	(—)	(—)	(—)	(—)	(—)	(19)	(1)	(30)	(3)	(5)	(—)	(—)	(5)	(—)	(—)	(—)	3	
Kotkhai	9	0.2	—	—	—	—	—	1	0.2	2	1	1	—	0.1	—	—	—	—	—	
	(3)	(—)	(—)	(—)	(—)	(—)	(—)	(10)	(3)	(26)	(10)	(10)	(—)	(—)	(2)	(—)	(—)	(—)	3	
Theog	13	0.2	—	—	—	—	—	4	0.1	4	1	0.3	—	0.3	—	—	—	—	—	
	(2)	(—)	(—)	(—)	(—)	(—)	(—)	(29)	(1)	(32)	(5)	(3)	(—)	(3)	(—)	(—)	(—)	(—)	3	
<i>Rainfall Zone—VI</i>																				
Mandi																				
Karsog	19	2	—	—	—	—	—	4	2	6	1	—	—	—	2	—	—	0.1	—	
	(10)	(—)	(—)	(—)	(—)	(—)	(—)	(20)	(8)	(30)	(3)	(—)	(—)	(12)	(—)	(—)	(1)	(—)	2	
<i>Rainfall Zone—VII</i>																				
Kangra																				
Nurpur	54	7	—	—	—	—	—	14	—	21	1	—	—	3	0.4	—	5	—	1	
	(13)	(—)	(—)	(—)	(—)	(—)	(—)	(25)	(—)	(29)	(2)	(—)	(—)	(6)	(1)	(—)	(9)	(—)	2	
Deragopipur	61	6	—	—	—	—	—	20	—	28	1	—	1	3	—	1	—	—	0.4	
	(10)	(—)	(—)	(—)	(—)	(—)	(—)	(32)	(—)	(45)	(1)	(—)	(2)	(6)	(—)	(—)	(2)	(—)	3	
Hamirpur	82	6	—	—	—	—	—	30	—	36	—	2	—	6	0.4	—	1	—	—	
	(8)	(—)	(—)	(—)	(—)	(—)	(—)	(36)	(—)	(44)	(—)	(21)	(—)	(8)	(1)	(—)	(1)	(—)	—	
<i>Rainfall Zone—VIII</i>																				
Simla																				
Simla	3	0.1	—	—	—	—	—	1	—	1	0.2	—	—	—	—	—	—	—	0.3	
	(3)	(—)	(—)	(—)	(—)	(—)	(—)	(38)	(—)	(43)	(6)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(10)	
Kandaghat	12	1	—	—	—	—	—	5	—	4	1	—	—	1	—	—	—	—	—	
	(8)	(—)	(—)	(—)	(—)	(—)	(—)	(42)	(—)	(33)	(8)	(—)	(—)	(8)	(—)	(—)	(—)	(—)	(—)	
Mehasu	7	0.1	—	—	—	—	—	3	—	2	0.3	—	—	—	0.3	—	—	—	1.3	
	(1)	(—)	(—)	(—)	(—)	(—)	(—)	(41)	(—)	(33)	(4)	(—)	(—)	(4)	(—)	(—)	(—)	(—)	(17)	

Rainfall Pattern—D₂E₂ (C₂D₂)D₂E₂

Rainfall Pattern—D₂E₂ (B₁C₂E₁) D₂E₂

Rainfall Pattern—D₂E₂ (B₂C₁E₁) D₂E₂

Rainfall Pattern—D₂E₂ (A₂C₁E₁) D₁E₃

Rainfall Pattern—D₂E₂ (A₂C₁E₁) D₁E₃

Rainfall Pattern—D₂E₂ (A₂C₂) D₁E₃

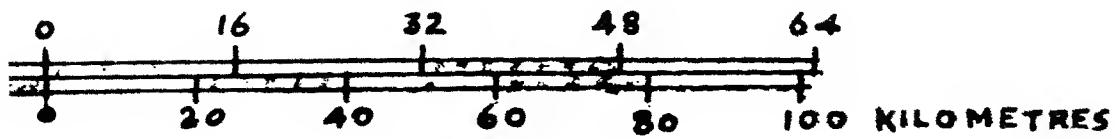
Rainfall Zone—IX												Rainfall Pattern—D ₂ E ₂ (A ₂ C ₂) D ₂ E ₂												
Mandi						Sunder Nagar						Mandi Sadar						Chichot						
14	2	—	—	—	—	5	0.2	5	0.3	0.1	—	—	—	—	—	—	1	0.1	—	—	—	0.1	0.1	
	(16)	(—)	(—)	(—)	(—)	(55)	(1)	(34)	(2)	(1)	(—)	(—)	(—)	(—)	(—)	(—)	(7)	(1)	(—)	(—)	(—)	(1)	(1)	
33	6	—	—	—	—	9	2	13	1	—	—	—	—	—	—	—	1	—	—	—	—	—	1	
	(19)	(—)	(—)	(—)	(—)	(27)	(5)	(39)	(33)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(3)	(—)	(—)	(—)	(—)	(1)	(3)	
19	1	—	—	—	—	5	—	6	3	1	—	—	—	—	—	—	1	—	—	—	—	—	2	
	(5)	(—)	(—)	(—)	(—)	(26)	(2)	(32)	(16)	(6)	(—)	(—)	(—)	(—)	(—)	(—)	(5)	(—)	(—)	(—)	(—)	(—)	(9)	
Rainfall Zone—X												Rainfall Pattern—D ₂ E ₂ (A ₂ B ₁ C ₁) D ₂ E ₂												
31	7	—	—	—	—	8	1	14	0.2	—	—	—	—	—	—	—	0.4	—	—	—	—	—	—	
	(22)	(—)	(—)	(—)	(—)	(25)	(4)	(45)	(1)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(2)	(—)	(—)	(—)	(—)	(—)	(—)	
25	5	—	—	—	—	5	2	9	1	0.3	—	—	—	—	—	—	0.4	—	—	1	—	—	0.3	
	(20)	(—)	(—)	(—)	(—)	(20)	(8)	(36)	(4)	(1)	(—)	(—)	(—)	(—)	(—)	(—)	(2)	(—)	(—)	(4)	(—)	(—)	(1)	
Rainfall Zone—XI												Rainfall Pattern—D ₃ E ₁ (B ₁ C ₂ E ₁) C ₁ D ₁ E ₂												
7	0.7	—	—	—	—	0.6	0.7	1.8	0.8	0.7	—	—	—	—	—	—	0.3	—	—	—	—	—	1.7	
	(10)	(—)	(—)	(—)	(—)	(8)	(10)	(24)	(11)	(10)	(—)	(—)	(—)	(—)	(—)	(—)	(4)	(—)	(—)	(—)	(—)	(—)	(24)	
15	2	—	—	—	—	3	1	5	2	2	—	—	—	—	—	—	0.4	—	—	—	—	—	0.5	
	(13)	(—)	(—)	(—)	(—)	(17)	(8)	(31)	(12)	(13)	(—)	(—)	(—)	(—)	(—)	(—)	(3)	(—)	(—)	(—)	(—)	(—)	(3)	
Rainfall Zone—XII												Rainfall Pattern—D ₄ (E ₄) D ₁ E ₃												
1	—	—	—	—	—	—	—	—	0.1	0.6	—	—	—	—	—	—	0.2	—	—	—	—	—	0.1	
	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(10)	(60)	(—)	(—)	(—)	(—)	(—)	(—)	(21)	(—)	(—)	(—)	(—)	(—)	(9)	
2	—	—	—	—	—	—	—	—	0.4	0.5	0.5	—	—	—	—	—	(11)	(—)	(—)	(—)	(—)	(—)	(3)	
	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(25)	(31)	(27)	(—)	(—)	(—)	(—)	(—)	(17)	(—)	(—)	(—)	(—)	(—)	(17)	
Lahaul and Spiti												Rainfall Zone—XIII												
Spiti	—	—	—	—	—	0.1	—	—	—	—	—	—	Rainfall Pattern—D ₄ E ₂ (E ₄) C ₁ D ₁ E ₂											
	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(8)	
Lahaul	—	—	—	—	—	—	—	—	—	—	—	—	Rainfall Zone—XIV											
Chamba	—	—	—	—	—	0.1	—	0.7	0.9	—	—	—	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	0.2	
Pangi	(—)	(—)	(—)	(—)	(—)	(3)	(—)	(24)	(31)	(34)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(8)	
Kullu												Rainfall Pattern—D ₄ E ₂ (E ₄) C ₁ D ₁ E ₂												
Hangrang	0.4	—	—	—	—	—	(—)	(—)	(25)	(50)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(1)	(33)	(45)	(—)	(—)	(—)	(—)	(—)	(11)	(—)	(—)	(—)	(—)	(—)	(—)	
Pooh	—	—	—	—	—	—	—	—	—	—	—	—	Rainfall Pattern—D ₄ E ₂ (E ₄) C ₁ D ₁ E ₂											
Morang	—	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)		
Kalpa	—	—	—	—	—	0.1	—	(3)	(—)	(11)	(28)	(41)	(—)	(—)	(—)	(—)	(6)	(—)	(—)	(—)	(—)	(—)	(11)	

APPENDIX 4 (Concl'd.)

District/taluks	Gross crop- ped area	Pd	jk	Jr	B	M	R	W	Ba	Mt	G	T	Fu	S	Gn	O	C	L	F	Misc.
<i>Rainfall Zone—XIV</i>																				
<i>Rainfall Zone—XV</i>																				
Kulu		10	0.2	—	—	—	—	—	3	2	1	—	—	—	—	—	—	—	—	
Banjar		(3)	(—)	(—)	(—)	(31)	(—)	(21)	(10)	(—)	(4)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	
Ani		8	0.5	—	—	—	1.1	—	2.5	1.7	1.3	—	0.3	—	—	—	—	—	0.4	
		(7)	(—)	(—)	(—)	(14)	(—)	(32)	(21)	(17)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(—)	(5)	
Nirmand		9	0.7	—	—	—	1.7	—	4	0.9	1.3	—	0.5	—	—	—	—	—	0.2	
		(8)	(—)	(—)	(—)	(18)	(—)	(43)	(10)	(14)	(—)	(—)	(5)	(—)	(—)	(—)	(—)	(—)	(2)	
<i>Rainfall Zone—XVI</i>																				
Kinnaur		2	—	—	—	—	—	—	0.1	0.2	1.4	—	—	0.1	—	—	—	—	—	0.2
Sangla		(—)	(—)	(—)	(—)	(—)	(—)	(—)	(5)	(10)	(70)	(—)	(—)	(5)	(—)	(—)	(—)	(—)	(—)	(10)
<i>Rainfall Zone—XVII</i>																				
Chamba		19	0.5	—	—	—	—	—	9	0.3	4	2	0.4	—	—	2	—	1	—	
Chamba		(3)	(—)	(—)	(—)	(47)	(2)	(21)	(10)	(2)	(—)	(—)	(10)	(—)	(—)	(5)	(—)	(—)	(—)	
		17	0.2	—	—	—	—	—	9	—	3	—	0.5	—	—	1	—	1	—	0.2
Chaurah		(1)	(—)	(—)	(—)	(53)	(—)	(18)	(12)	(3)	(—)	(—)	(6)	(—)	(—)	(6)	(—)	(—)	(1)	
<i>Rainfall Zone—XVIII</i>																				
Kulu		24.0	2	—	—	—	—	—	6	—	7	3	3	—	—	2	—	1	—	
Kulu		(8)	(—)	(—)	(—)	(25)	(—)	(29)	(13)	(13)	(—)	(—)	(8)	(—)	(—)	(4)	(—)	(—)	(—)	
Chamba		5.0	—	—	—	—	—	—	1.2	0.1	1.4	0.8	1.4	—	—	0.4	—	—	—	0.2
Brahmaur		(—)	(—)	(—)	(—)	(23)	(1)	(25)	(16)	(25)	(—)	(—)	(8)	(—)	(—)	(—)	(—)	(—)	(2)	
Kinnaur		4.0	—	—	—	—	—	—	0.2	0.8	0.9	2	—	—	—	—	—	—	—	0.2
Nachhar		(—)	(—)	(—)	(—)	(—)	(—)	(—)	(6)	(20)	(22)	(46)	(—)	(—)	(—)	(—)	(—)	(—)	(6)	
<i>Rainfall Zone—XIX</i>																				
Kangra		51.1	14	—	—	—	—	—	9	—	18	1	1	—	—	1	—	4	—	
Palampur		(28)	(—)	(—)	(—)	(18)	(—)	(35)	(2)	(2)	(—)	(—)	(2)	(—)	(—)	(7)	(—)	(6)	(—)	
Kangra		42.1	13	—	—	—	—	—	8	—	16	1	—	—	—	1	—	2	—	
Chamba		(30)	(—)	(—)	(—)	(38)	(—)	(37)	(2)	(—)	(—)	(—)	(2)	(—)	(—)	(5)	(—)	(1)	(5)	
Bhattiyat		16	3	—	—	—	—	—	5	—	5	2	—	—	1	—	—	—	—	
		(18)	(—)	(—)	(—)	(31)	(—)	(31)	(13)	(—)	(—)	(6)	(—)	(—)	(1)	(—)	(—)	(—)	(—)	
<i>Rainfall Pattern—D₄ (B₂C₁E₁) D₁E₃</i>																				
<i>Rainfall Pattern—C₁D₃ (B₁C₂E₁) C₂D₁E₁</i>																				
<i>Rainfall Pattern—C₂D₂ (C₂D₂) C₁E₃</i>																				
<i>Rainfall Pattern—C₁D₂ (A₂B₁C₁) C₂D₁E₁</i>																				



The area covered by a rainfall pattern is termed a zone and the zones in the map are serially numbered. Roman numbers indicate State rainfall zones and three digit figures in Arabic numerals within brackets give their corresponding All-India equivalents.



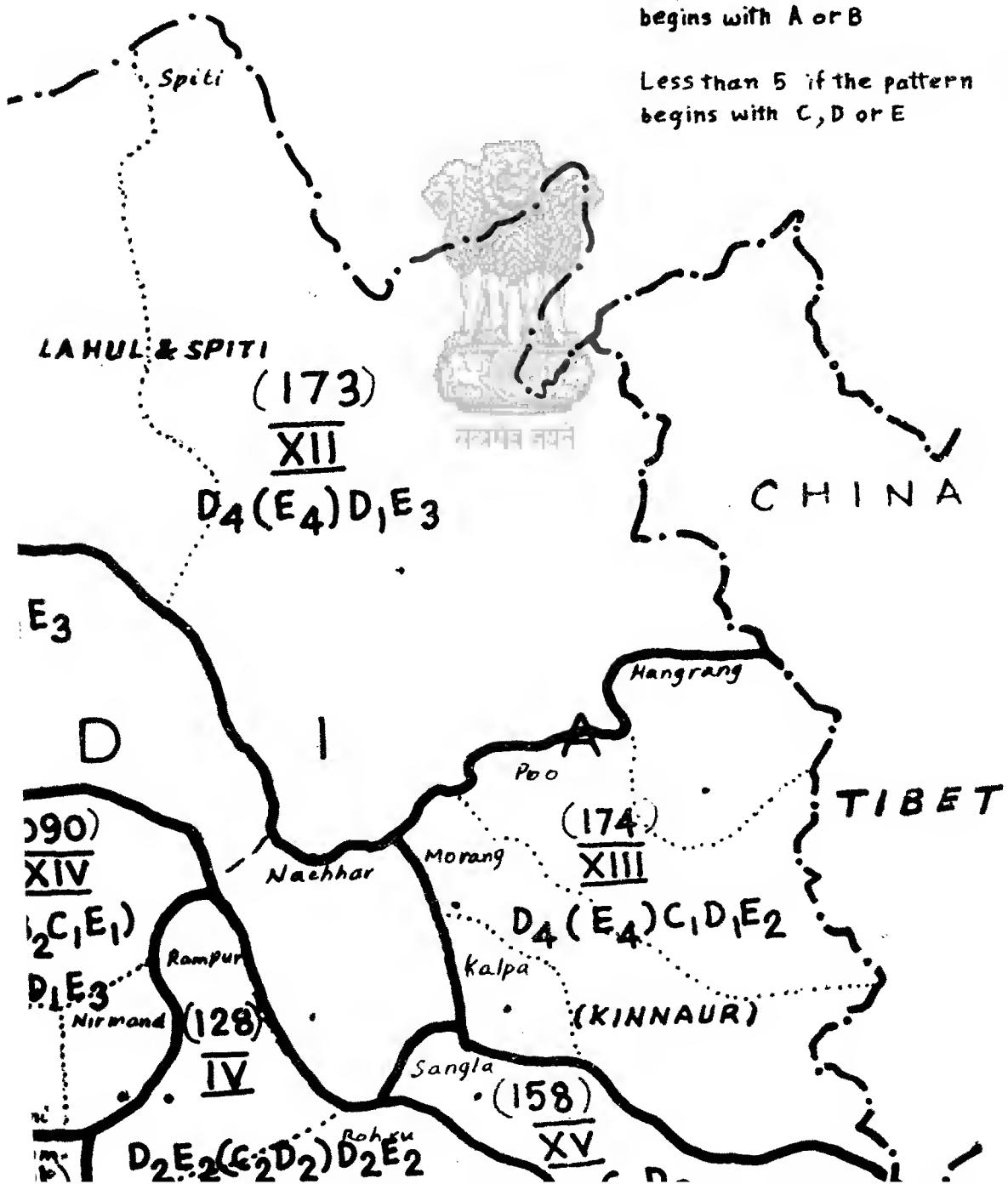
APPENDIX V
LEGEND

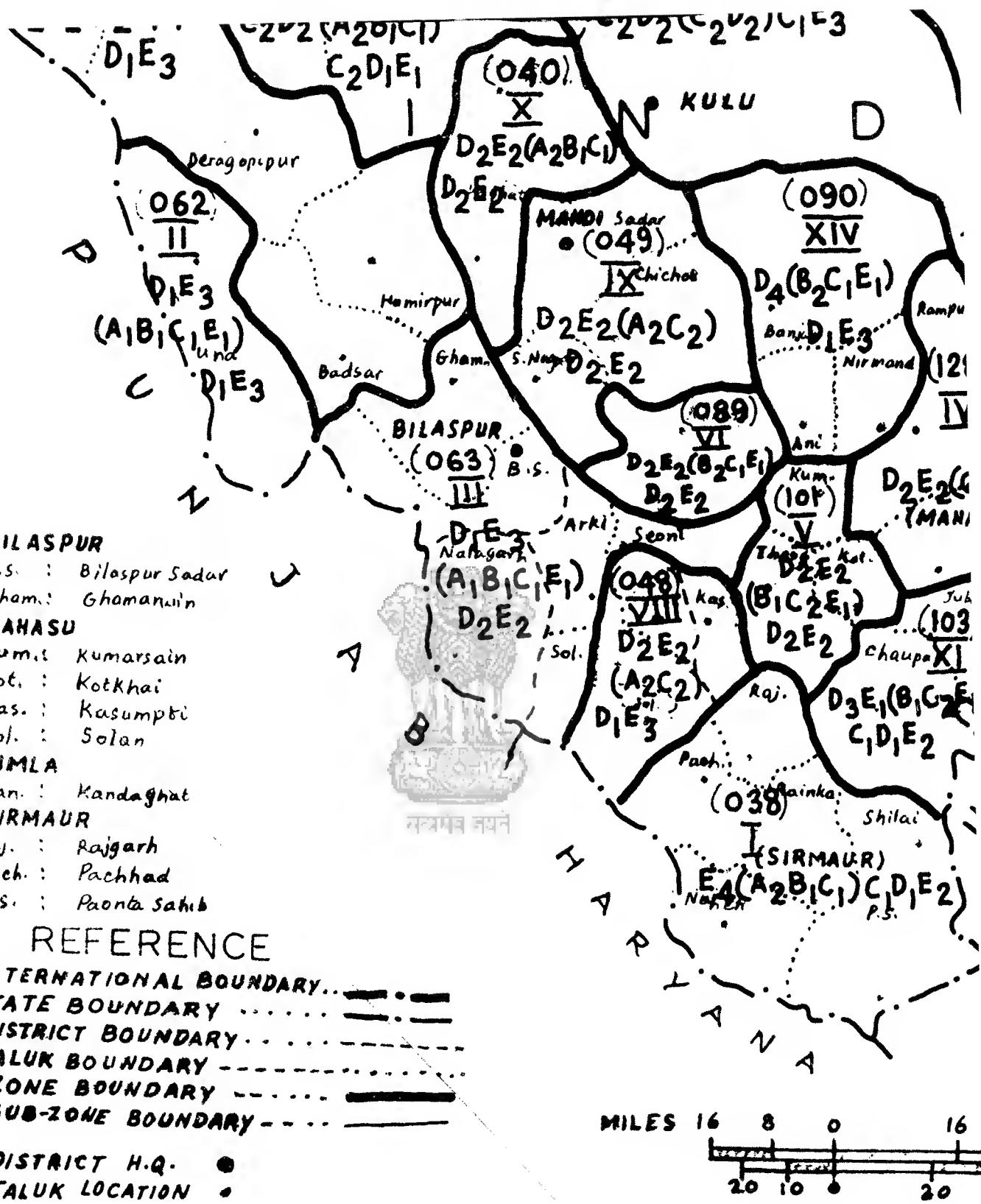
PRADESH PATTERNS

The rainfall pattern which describes the distribution of monthly rainfall throughout the year is expressed in coded form with letter symbols and numerical subscripts. A letter denotes a rainfall interval and the subscript to each letter the number of months in the interval

Symbol	Rainfall interval centimetres per month
A	Greater than 30.
B	20-30
C	10-20
D	5-10
E	Less than 10 if the pattern begins with A or B

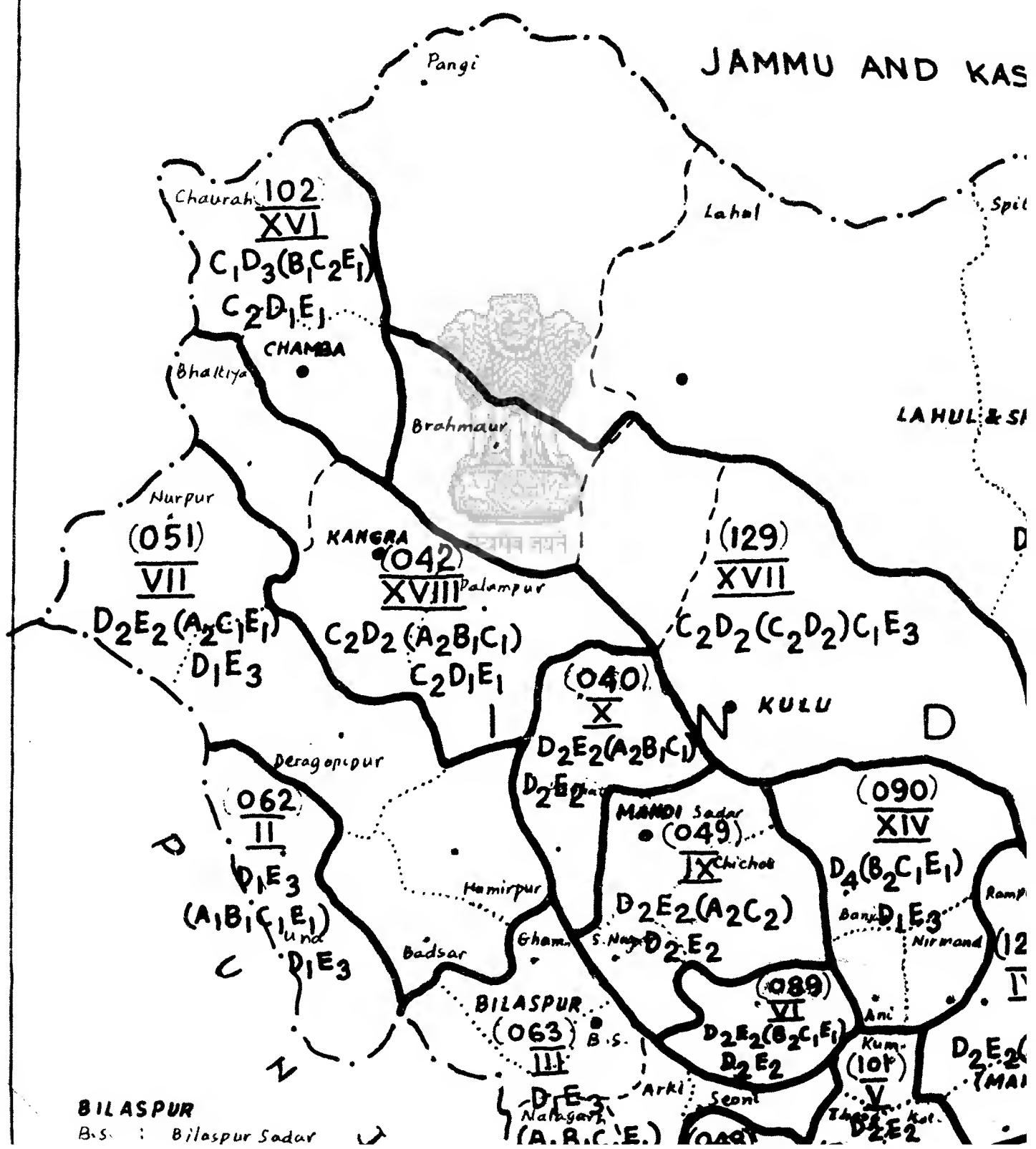
IND KASHMIR

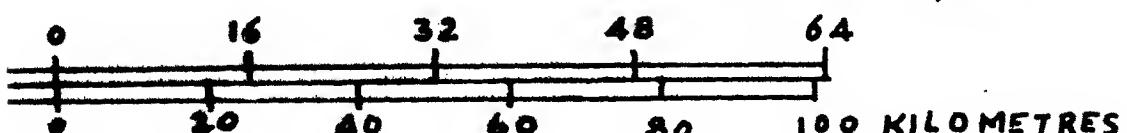
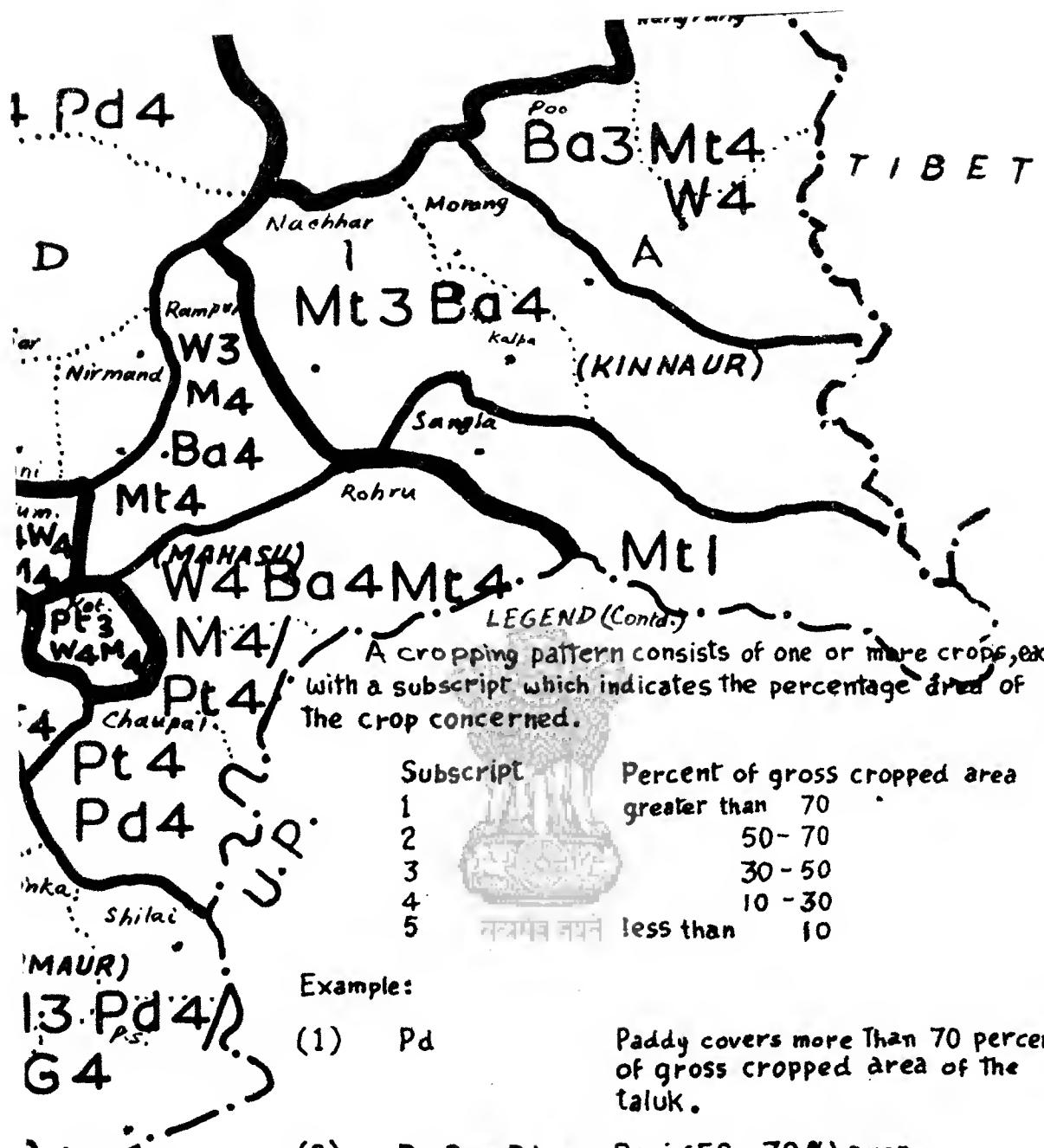




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HIMACHAL PRADE RAINFALL PATTER

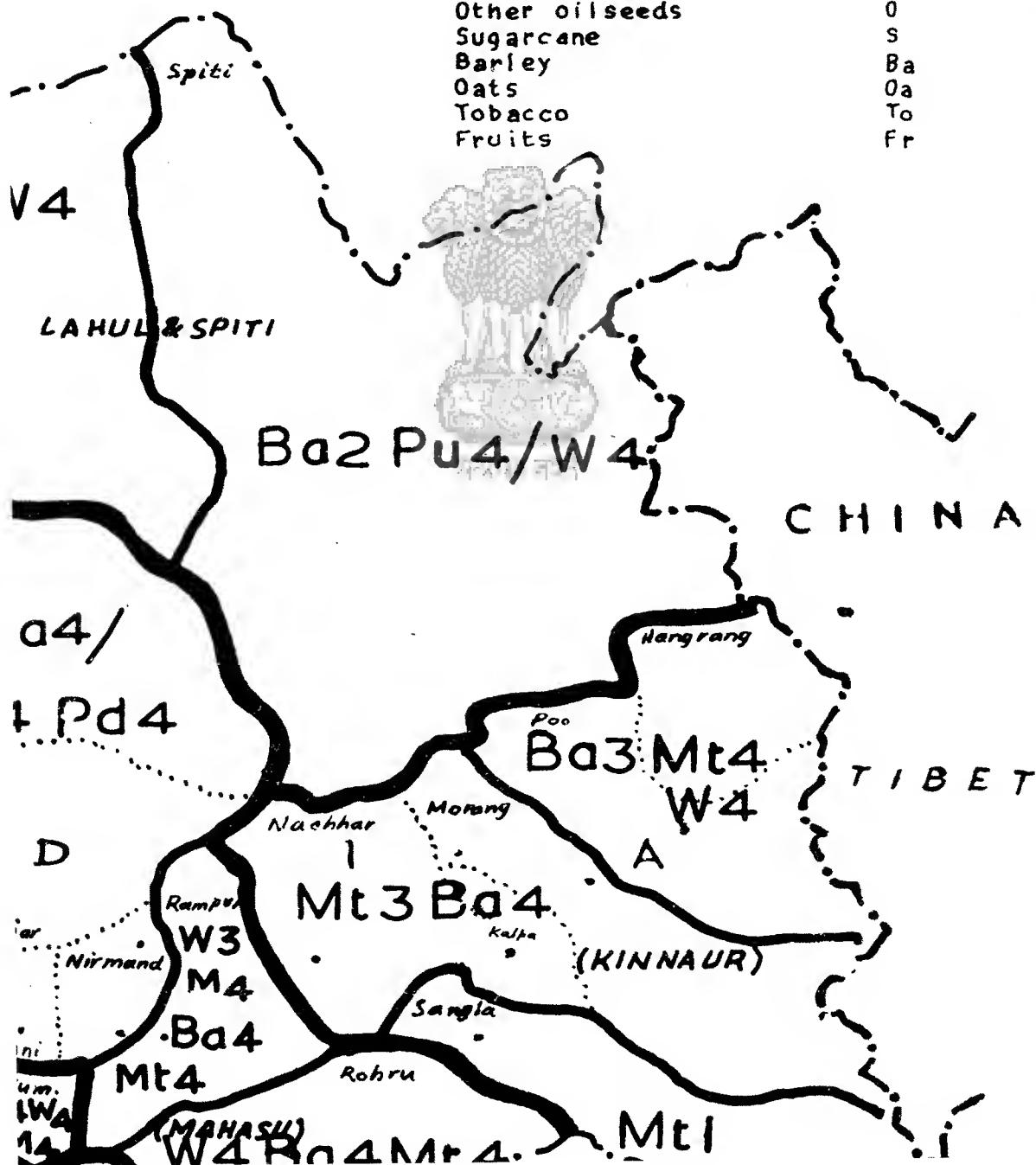


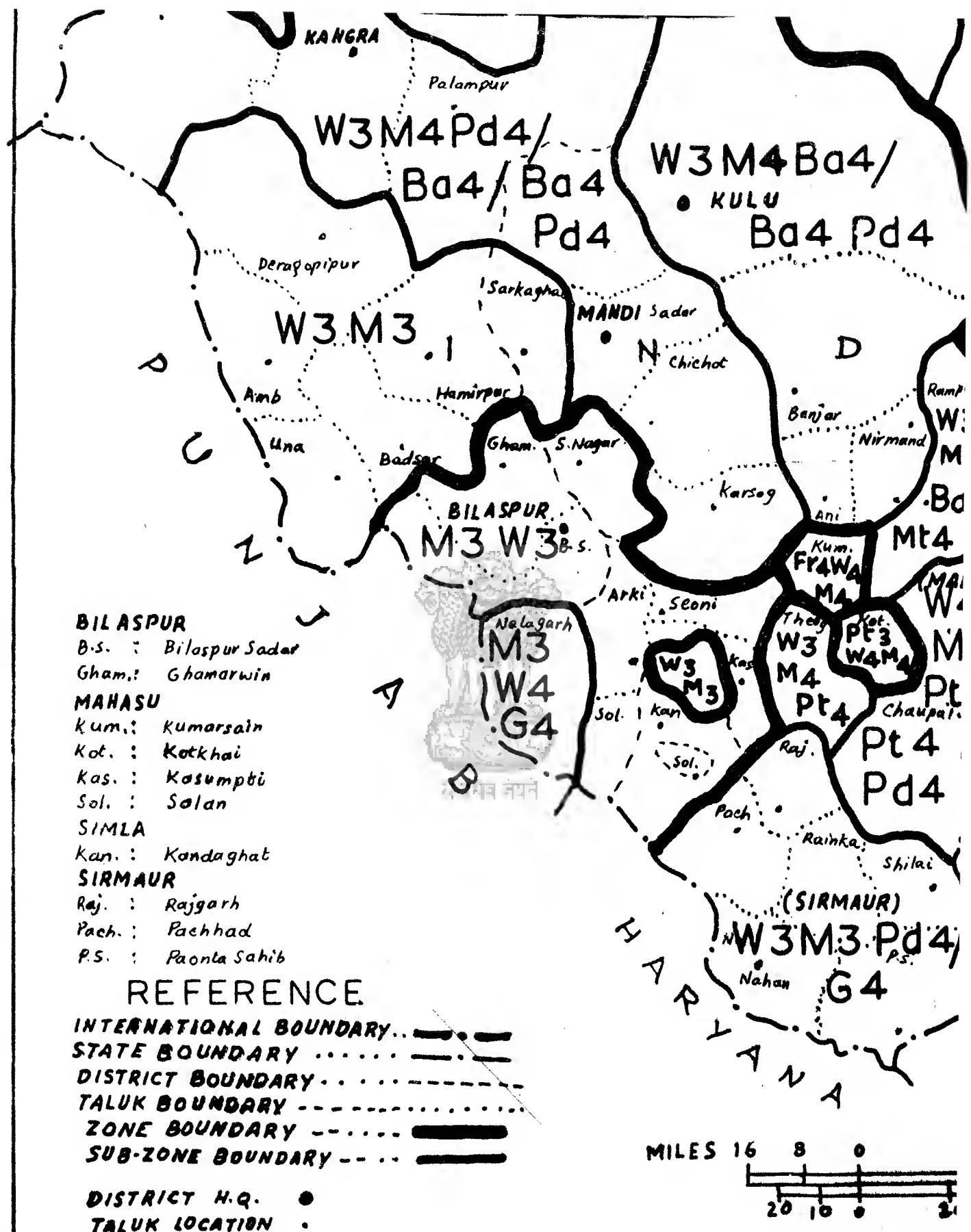


LEGEND

PRADESH ATTERNS

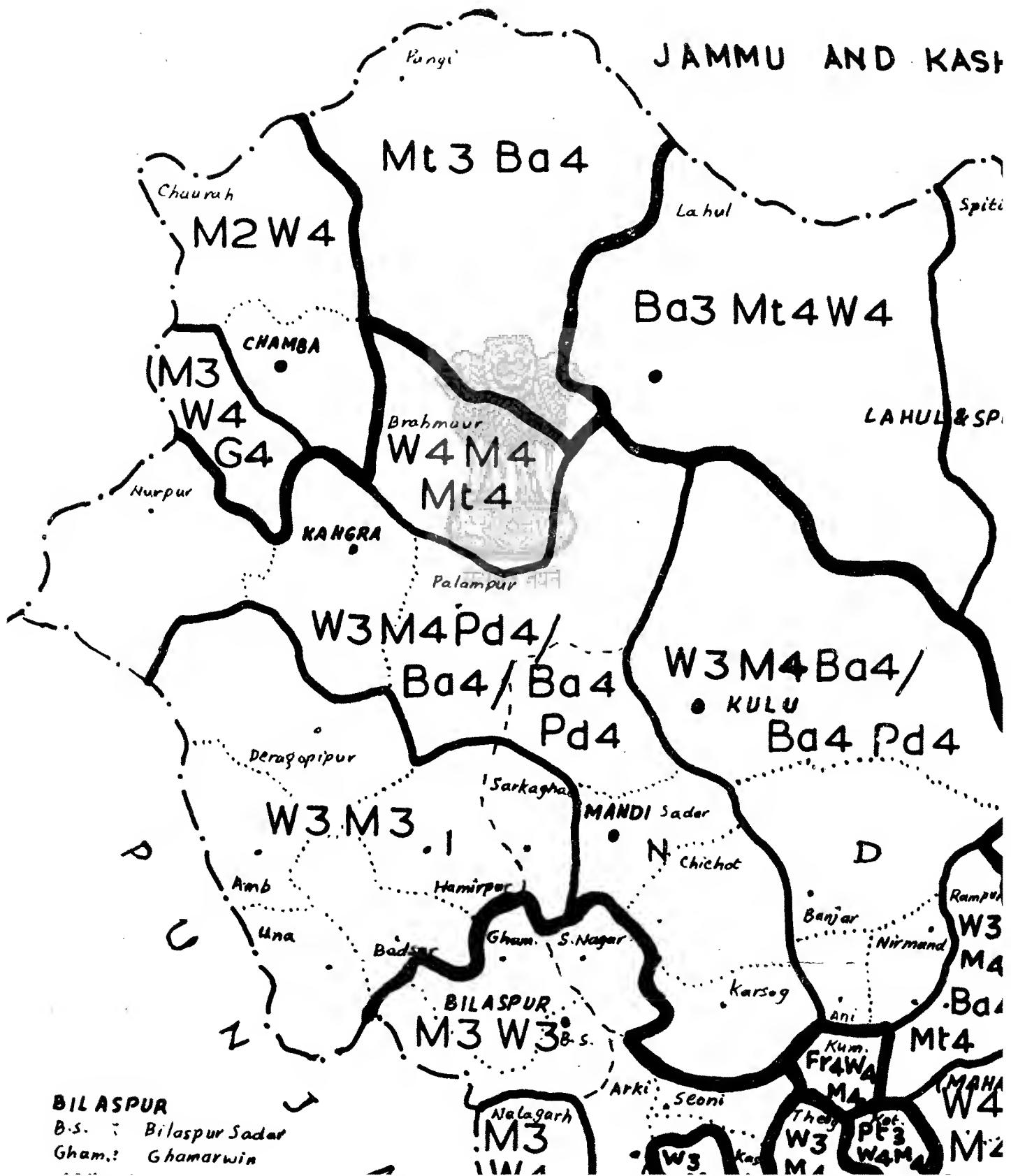
ND KASHMIR

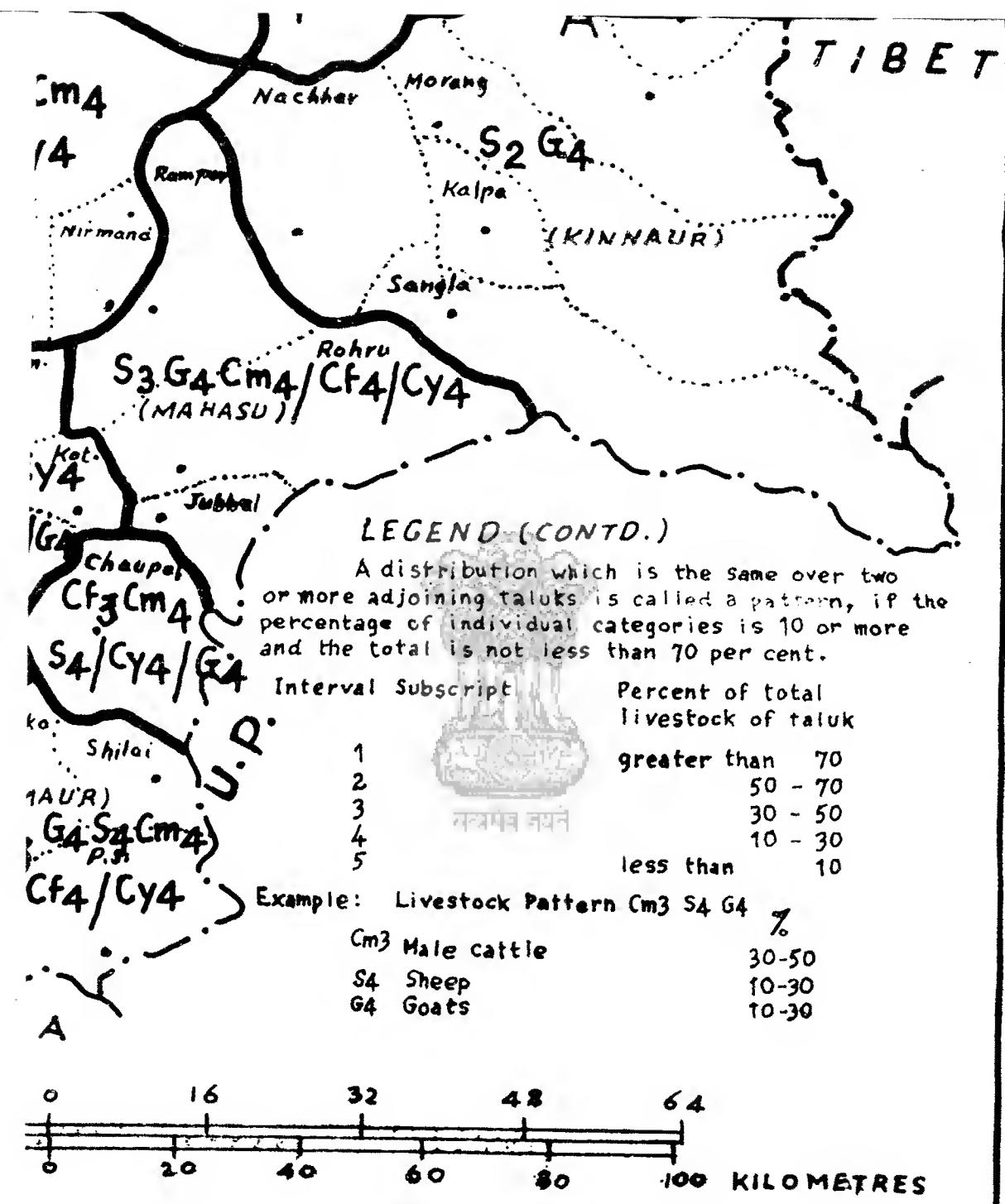




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HIMACHAL PRADE CROPPING PATTERN





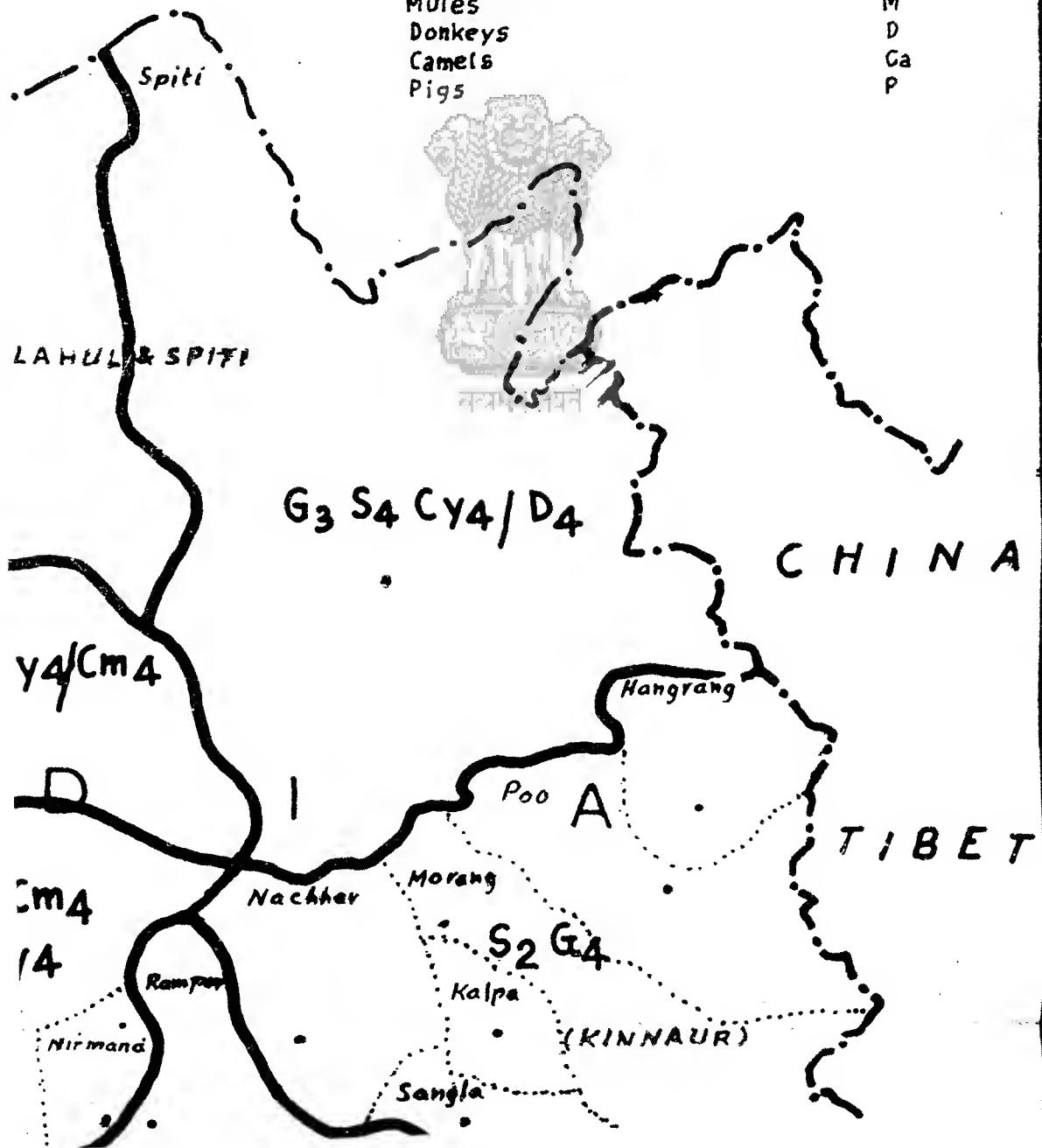
APPENDIX VII

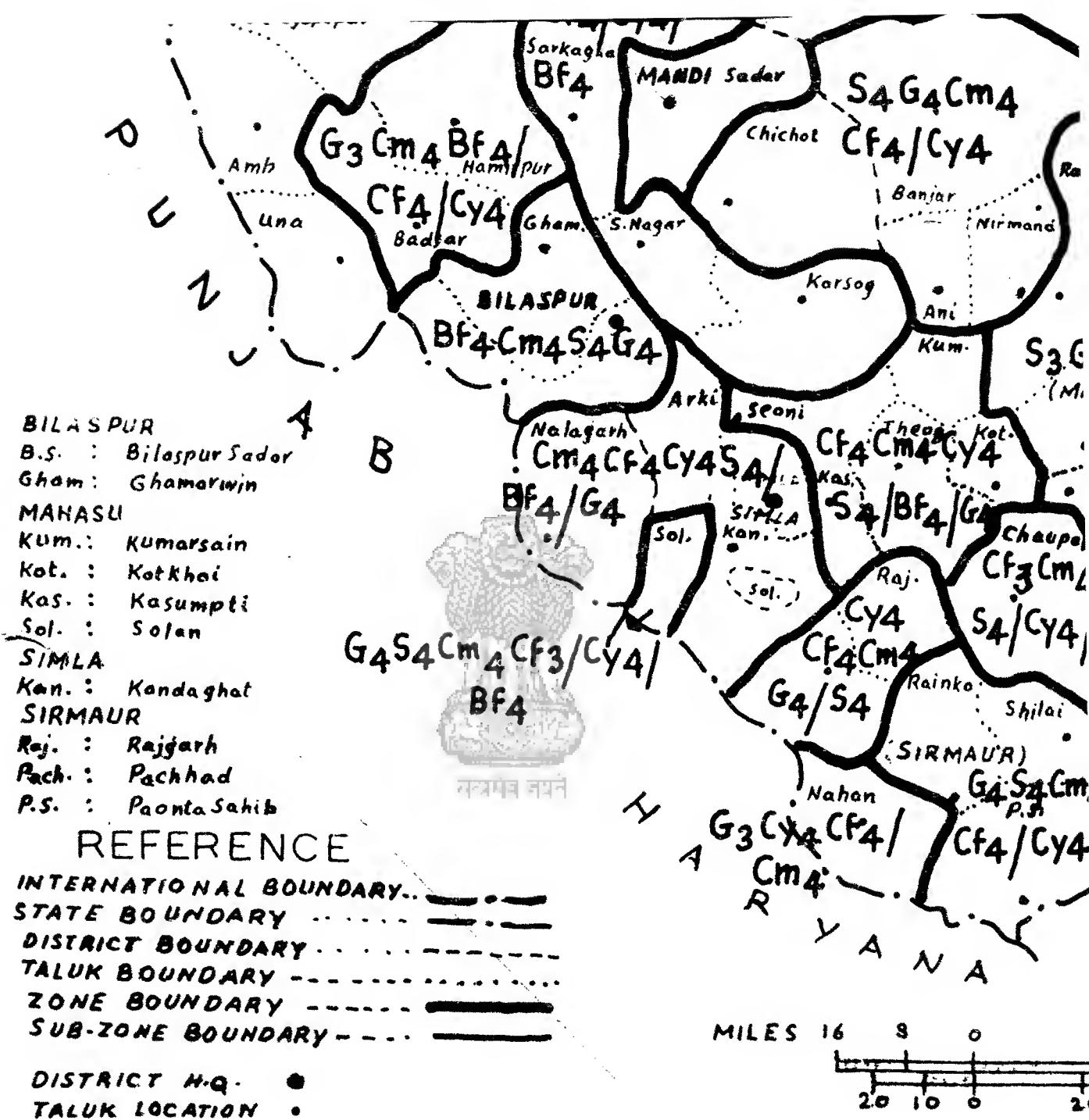
LEGEND

PRADESH

ATTERNS

AND KASHMIR





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HIMACHAL PRAI LIVESTOCK PATTE

